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FRESH WATER MOLLUSKS OF CAPE MAY POINT, NEW JERSEY

By ROBERT C. ALEXANDER

Although more than two-thirds of Cape May County, the southernmost county in New Jersey, is surrounded by salt water, there are several fresh water lakes within its borders. Two of them, besides a smaller fresh water pond, are within sound of the waves at the point where the bay and ocean meet.

Lily Lake (Lake Lilly), 650 yards long and 200 yards wide at its greatest width, nestles among the pine woods at Cape May Point just off the highway. It is a fairly shallow, spring-fed lake with a muddy bottom and, apparently, no effectual outlet.

Before the coming of the white man, the lake supplied sweet water[1] for the Kechemeches, a band of Indians belonging to the peace-loving Lenni-Lenape or Delaware tribe, who hunted birds and small game, fished, and dug mollusks at the Point; and it was known to the first white settlers, whalers and their families from New England and Long Island, who settled on the bay shore a short distance above the Point in the middle of the seventeenth century.

During the American Revolution, patriotic residents on the cape dug a huge ditch passing through sand dunes at places sixteen feet high from Lily Lake to Pond Creek which emptied into Delaware Bay to let in salt water and frustrate the plans of the captains of British warships who were accustomed to anchor off the point send parties ashore to fill the ships' casks with fresh water from the lake.

On several occasions between twenty and thirty years ago, the ocean washed over the meadows between Cape May and Cape May Point, flooding them deep with water. The flood waters

[1] The Indians called fresh water "sweet water" and salt water "bitter water."

backed up into Lily Lake and again it was filled with salt water as it had been during the Revolution.

In spite of the introduction of salt water in the past, the water in the lake is nearly, if not entirely, fresh now. Handsome and fragrant water lilies bloom on its surface all summer long; and it is inhabited by bass, perch, carp, catfish, eels, frogs, turtles, harmless snakes and at least five species of small mollusks.

On September 25, 1946, I found the shells of *Physa heterostropha* (Say), *Pseudosuccinea columella* (Say), *Gyraulus parvus* (Say), and *Musculium partumeium* (Say) on soft wet mud at a spot usually under water below an oak tree standing by itself on the east bank at the narrow north end of the lake. Further investigation disclosed all of these species except *Musculium partumeium* alive. They were clinging to the bottom of lily pads and other objects in the water near the shore together with the fresh water limpet *Ferrissia rivularis* (Say).

More than fifty shells of *Physa heterostropha* were collected, the largest ones being only about half the usual size. The lake seems to be inhabited by a dwarf race of this species. The tendency toward smallness is noticeable in other species here and is probably due to ecological conditions.

Less than a mile above Lily Lake, on the bay shore between Cape May Point and Higbees Beach, is Davey's Lake. It is a fairly deep, spring-fed lake, 340 yards long and 80 yards wide, hidden among the sand dunes 150 yards in from the bay. The bottom is sandy except for a few places along the west shore, and there is no visible outlet. Recently, large areas of the lake have been overgrown with pondweed.

The lake was dug by the Cape May Sand Company about 1910, and named for old David Wiltshire, a well-liked employee of the company, who helped to dig it.

Although digging operations at the lake were abandoned many years ago, remains from the time when the lake was being dug can still be seen—stretches of the old railroad used to haul sand from the lake to the sand plant with some of the old wooden railroad ties still in place; lengths of steel cable coiling in and out of the sand in clearings among thickets of cedar, holly, bayberry, and beach plum growing on the shore; a mound of cinders rising above dwarf sumac, groundsel, and dune grasses inter-

spersed with the ever-present poison ivy; and a rectangular wooden bulkhead formerly used to support dredging apparatus, almost submerged in the water.

When the first warm sunny days of spring make lessons a chore, schoolboys from nearby sneak away to Davey's Lake to forget their assignments and go buck bathing in the clear cool water. And charred wood on the sand by the water's edge marks the spot where a fire made by a party of young people burned bright under a starry summer sky.

Like Lily Lake, Davey's Lake is inhabited by fish, frogs, turtles, harmless snakes—black snakes, ribbon snakes, water snakes—and at least two species of small mollusks.

Pseudosuccinea columella (Say) lives sparsely along the west shore. Colonies of *Physa heterostropha* (Say) can be found half-buried or hidding under objects along the water line in the east and west bays, and along the west shore near the narrow south end of the lake. I collected both species there October 3, 1946. They may have been introduced accidentally with bass with which the lake has been stocked from time to time.

The following list presents comparative measurements for the largest shell of each species collected in the lakes and Say's types: *Physa heterostropha* in Lily Lake, 5/16 inch; in Davey's Lake 1/2 inch; Say's type, 9/16 inch. *Pseudosuccinea columella* in Lily Lake, slightly over 1/2 inch; in Davey's Lake 7/16 inch; Say's type, nearly 7/10 inch. *Gyraulus parvus* in Lily Lake, 1/8 inch; Say's type, 1/5 inch. *Ferrissia rivularis* in Lily Lake, slightly over 1/8 inch (Say's type, 1/4 inch). *Musculium partumeium* in Lily Lake, 3/10 inch in length, 7/20 inch in breadth (Say's type, 9/20 inch in length, 11/20 inch in breadth).

REPORT ON THE LAND MOLLUSKS OF CAPE MAY, N. J.

By ROBERT C. ALEXANDER

(Continued from January number)

William B. Marshall reported finding a single specimen of *Succinea avara* Say "on the ocean front at 8th Avenue, Mount Vernon (now South Cape May), between Cape May City and Capt May Point . . . not more than 200 feet from the line of high tide" in August, 1890. Dr. Pilsbry, comparing other specimens obtained from that locality by Marshall, reported that they "seem referable to *S. aurea* rather than to *S. avara;* though it must be acknowledged that the determination of Succineas is often far from certain."

Many changes have occurred at South Cape May since Marshall made his collections there. The ocean has cut into the shore; many of the houses and hotels that used to stand there have been washed away by the ocean; and almost every vacant lot has some of the wreckage of old buildings scattered over it. Sometimes during the fall and winter when the ocean is whipped by storms and tides run unusually high, great waves sweep over the crest of the beach and wash through the streets to the meadows beyond with such force it seems as if they would destroy the dozen and a half buildings that still remain.

In spite of time and the ocean, *Succinea aurea* can still be found alive at South Cape May. After a brief search, I found living specimens, mostly under boards in the quarter-block area at the southwest corner of 9th Avenue (Bayshore Road) and Mount Vernon Avenue, only a block from where Marshall found his original specimen in 1890.

The largest one I collected and two or three smaller ones were clinging to the under side of a broken section of shingle roof lying on the sand beside a clump of dune grass and goldenrod less than fifty feet from the line of normal high tide.

For half an hour or more, I sat on an old log beside a small stagnant pool in this same quarter-block area examining a heap of broken sticks lying on the wet ground to see if there were

mollusks on any of them. Small *Deroceras reticulatum* (Müller) and *D. laeve* (Müller), two species of slugs often found together, were under most of the damp sticks. The place, as the saying goes, was literally crawling with them. In many cases, the sticks were shared with *Vertigo ovata* Say.

I used a light stirring spoon with a slender handle and a bowl half an inch in diameter to transfer the tiny shells of *Vertigo ovata* to a glass vial pushing or rolling the shells into the bowl with the tip of one finger. Generally, I prefer this method for collecting tiny shells to attempting to pick them up between the fingers, an almost impossible undertaking, or using tweezers where too much pressure, however unintentional, will crush the little shells to fragments.

While I was collecting these shells, one of the few residents remaining at South Cape May so late in the year came to find out what I was doing, suggested that I hunt for larger shells that were often washed up on the beach by the surf and were much easier to see them than such little ones, and cheerfully began to help me when I persisted in my search for the little ones.

The October sun was setting behind a bank of gray clouds and a chill wind was blowing in from the ocean when I left South Cape May that afternoon. I had collected a dozen or more *Succinea aurea* Lea, several *Deroceras reticulatum* (Müller), and *D. laeve* (Müller), and forty or fifty *Vertigo ovata* Say ranging from young to full-grown individuals. The helpful resident had long since returned home.

The following species of land mollusks were collected at Cape May, 1945–1946, and are now in the collection of the Academy of Natural Sciences of Philadelphia. Cape May Point: *Deroceras laeve* (Müller), *Strobilops labyrinthica* (Say), *Triodopsis albolabris* var. *maritima* (Pilsbry), *Vertigo milium* (Gould), *V. pygmaea* (Drap.), *Zonitoides arboreus* (Say); a young specimen tentatively identified as *Gastrocopta pellucida* var. *hordeacella* (Pilsbry) was found in earth taken from a cedar grove on the bay shore behind the sand plant. Cape May City: *Cochlicopa lubrica* (Müller), *Deroceras reticulatum* (Müller), *Limax maximus* Linné, *Mesodon thyroidus* (Say), *Vertigo pygmaea* (Drap.), *Zonitoides arboreus* (Say). South Cape May: *Dero-*

ceras laeve (Müller), *D. reticulatum* (Müller), *Succinea aurea* Lea, *Vertigo ovata* Say.

Dr. Pilsbry collected the following species at Cape May in August, 1898: Cape May Point, where he noted "the snails are everywhere, so far as my own experience goes, confined to the cedar groves": *Deroceras laeve* (Müller), *Gastrocopta pellucida* var. *hordeacella* (Pilsbry), *G. pentodon* (Say), *Triodopsis albolabris* var. *maritima* (Pilsbry), *Vertigo milium* (Gould), *Zonitoides arboreus* (Say). *Hawaiia minuscula* (Binney) was found "a few miles further northwest." Cape May City: *Vallonia pulchella* (Müller) and *Pupoides marginatus* (Say) at the gas works on Lafayette Street.

Other species collected at Cape May: *Oxychilus cellarium* (Müller), cement wall at Cape May City (James B. Clark, 1933); *Vallonia excentrica* Sterki, Cape May City (Robert Walton Collection, undated); *Helicodiscus parallelus* (Say), Cape May Point (Witmer Stone, 1918).

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PRELIMINARY OBSERVATIONS ON REPRODUCTION IN THE MOLLUSCAN GENUS MUSCULIUM

By HARLEY J. VAN CLEAVE, A. GILBERT WRIGHT, and C. WILLIAM NIXON

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The genus *Musculium* of the molluscan family Sphaeriidae has been but little investigated for details of its reproductive habits. Gilmore (1917), in his treatment of the morphology, reproduction and growth of various species of the family, gave brief consideration to *Musculium truncatum*. Aside from occa-

sional isolated notes, this is the only treatment of reproduction in a member of this genus. A series of five biological studies by K. Okada (1935–1938) on *Musculium heterodon* of Japan is often cited in the literature. However, in the fourth section of this series of papers there is a correction indicating that the species had been erroneously identified. In a footnote it was revealed that the species studied was not a *Musculium* but the material represented two distinct varieties of *Sphaerium japonicum*.

The question of validity of *Musculium* as a genus distinct from *Sphaerium* has been raised frequently, most recently by Brooks and Herrington (1944). It has long been recognized that *Sphaerium* and *Musculium* have many features in common. Many investigators see in their similarity evidence of common ancestry which is best reflected by placing the two genera in the same sub-family (Sphaeriinae) while others are just as sure that the same evidences indicate such close relationship that the two nominal genera represent but one valid genus. Some of the observations presented in the present paper indicate rather pronounced differences between one species of *Sphaerium* and certain species of *Musculium*. Here again, a decision cannot be reached until other species are investigated to determine if the differences are purely specific or if they reflect taxonomic distinctions of a higher order.

Throughout the literature on Sphaeriidae, taxonomic distinctions at all levels have always been made with considerable difficulty. The late Dr. Sterki was the only recent American worker who had directed enough attention to members of the family to be recognized as a competent authoritative specialist on the group. Unfortunately, many of his observations and conclusions regarding species and varieties have never been published. This is particularly unfortunate since there seems to be a very general tendency to believe that his enthusiasm for the group led him to recognize minor shell and habitat difference which some other students consider as relatively unimportant and unstable as taxonomic characteristics. The present writers would warn that wholesale rejection of Sterki's conclusions on species and subspecies by present day conchologists might lead to serious errors in interpretation of the biology and taxonomy of members of this family.

For more than a quarter of a century, the senior author of this paper has collected Sphaeriidae in central Illinois and in adjoining states. Many of these collections were sent to Dr. Sterki who always identified the lots and reported on them with apparent enthusiasm. His holograph reports often contained references to manuscript names with notes on geographical and ecological distribution of the new forms and observations on the distinctive features of the shells. In collections from Urbana, Illinois, several lots taken at various times from small, weedy streams and ox-bow ponds were reported as representing a species previously undescribed but close to *Musculium partumeium* (Say). The manuscript name will not be cited here since its occurrence in print might add confusion to a nomenclatorial problem already seriously involved. The specimens which Dr. Sterki intended to designate as types of his new species close to *M. partumeium* (Say) are doubtless in his collections and his manuscript notes are probably available. The senior author of this paper has a small series named by Dr. Sterki which he would be glad to make available to anyone seriously interested in the taxonomic problems involved.

Specimens from a similar habitat, an artificially created ox-bow pond at Urbana, Illinois, locally dignified with the name "Crystal Lake," were submitted to the United States National Museum for identification. Dr. Paul Bartsch named these specimens *Musculium partumeium* (Say). These seem in every way identical with collections which have come from other local weedy ponds and ditches. Representatives from this one habitat have now been under observation for a number of years. The present study is confined to observations on the natural populations and on the number and size of the marsupial young. Mr. A. Gilbert Wright studied periodic samples through the summer and fall of 1945 and C. William Nixon made similar studies in the summer of 1946. The results are too fragmentary to be presented in detail but some of the observations will be presented at this time.

The shells living normally in this habitat ranged from 1.5 to 10.8 mm. in length, although there were but few individuals that reached a length of 9 mm. In the field collecting, 829 individuals of *M. partumeium* were taken from July 6 to November

10, 1945. Of this number only 36 shells were 9 mm. or more in length and only 3 exceeded 10 mm. The largest shells were found chiefly from July to September. In October and November there was an increasingly great number of large dead shells encountered while collecting the samples. The fact that living shells of the largest size group were wholly lacking in the November collection suggests the possibility that in this species, as Foster found in *Sphaerium solidulum*, most individuals live somewhat less than a year.

A representative series of several collections was dissected under a wide field dissecting binocular microscope to secure information on the number and size of the marsupial young. The brood chambers are borne on the inner gills, with characteristically a large and a smaller pouch in each inner gill. Complete observations were made on the young carried by 112 individuals in two collections taken in June and July, just two weeks apart. In this species there seems to be no set size at which individuals begin to bear young. Most of the individuals having a shell length of 4 mm. or more bore young in some stage of development. One specimen only 3.5 mm. long carried two marsupial young 0.585 and 0.668 mm. respectively.

Foster (1932, page 486) called attention to the fact that in *Sphaerium solidulum* each gill of a gravid female characteristically contained either one or two young, making a total of 2 or 4 borne by the parent individual. In the habitat under consideration, *Musculium partumeium* is much more prolific than *S. solidulum*. Eight to 18 were very common numbers of marsupial young in the former. Gilmore (1917) recorded finding 24 marsupial young in one individual of *Musculium truncatum*. If such a distinction in numbers of young should be found in other species of *Musculium* and *Sphaerium*, this biological fact might add support to the morphological differences between the two genera.

Marsupial young under 0.6 mm. in length very rarely had a definite shell and as embryos were not included in the measurements. At the upper end of the scale, young 1.3 to 1.5 mm. in length were not uncommon. The latter size is that at which many individuals become free living and some were encountered

in the field collections. Gravid individuals frequently shed young prematurely when handled. This fact may account for the occurrence of some exceptionally small individuals found in preserved field samples.

While there is considerable variation in the size of the young of the same brood pouch, the marsupial young in a given parent individual are very commonly of two distinct sizes. The disparity in numbers of young in the brood pouches of the same individual was rather great. In many individuals having but a few of the advanced young and greater number of the smaller size brood this was probably due to the fact that some of the largest young had been discharged, either normally or prematurely. In only about one fourth of the individuals studied were there identical numbers of young in the two gills but in no instance was the number in one gill more than four greater than in the other gill of the same parent. In considering the sizes of the young recorded for each parent, there seemed to be a strong tendency for many of the measurements to be "paired." Often the two or more young of identical size were in the same gill but in many instances they were on opposite sides of the body. A single example of the contents of the more mature brood pouches borne by a 6.2 mm. individual will be cited, with the paired members of the brood indicated:

	Size of young in mm.			
Left gill:	1.25 paired	1.27 paired	1.27	....
Right gill:	1.25	1.29 paired	1.29	1.14

Soon after the fully formed young are set free, a new brood of embryos starts to form. In no instance have embryos, small marsupial young and large marsupial young been observed in the same individual.

As originally planned this study was to be carried throughout the year. A few individuals of *Sphaerium* and *Pisidium* began to appear in the habitat under observation. Certain recognition of the newly born young demanded such close scrutiny for segregation that the study was abandoned.

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A NEW SUBGENUS, PAENISCUTALUS, AND THE ANATOMY OF ITS TYPE SPECIES

By CHARLES B. WURTZ

Through the kindness of Dr. Joseph Bequaert, I have had the opportunity to dissect specimens of the snail hitherto known as *Megalobulimus* (*Microborus*) *incarum* Pilsbry under the direction of Dr. H. B. Baker, to whom I am much indebted for guidance. I also want to thank Dr. H. A. Pilsbry for the interest he has so generously displayed in this problem.

The dissection was made to determine the position of *Megalobulimus incarum* Pils., which Dr. Pilsbry described as a new species of Strophocheilidae (Naut. 58: 29). The description of this species was based on two dead shells lacking periostracum, and with the sculpture of the nepionic whorls nearly obliterated. The type and paratype are number 180677 in the collection of the Academy of Natural Sciences of Philadelphia. These were collected by Dr. W. Weyrauch at Huaraz, Peru, at an elevation of 3000–3200 meters.

Dr. Bequaert received considerably more of this material from Dr. Weyrauch, and also received five living animals from

Tapacocha, Peru (elevation 3000–3500 meters). He suggested that this species was a member of the Bulimulidae rather than of the Strophocheilidae, and the dissections prove him correct.

The genus *Bulimulus* Leach (Man. Conch. 10: 125) contains those bulimuli "with apical whorls either smooth, vertically costulate or wrinkled, or with the wrinkles interrupted and broken into granules." Pilsbry further divides the genus into three divisions on the basis of the sculpture of the nepionic whorls. (Pilsbry, however, states that this is but a classification for convenience, not infallible, and secondary to anatomical structures.) The second division, comprised of those forms "sculptured with waved, zig-zag or irregular vertical wrinkles," contains three subgenera: *Plecostylus* Beck, *Scutalus* Albers, and typical *Bulimulus* (s.s.). These are separable on conchological and anatomical characters. Pilsbry (Proc. Acad. Nat. Sci. Philadelphia 82: 356, 1930) proposes *Pseudoxychona* as a new section of *Bulimulus*. Thiele (Handb. Syst. Weichtierk., 2nd part, p. 656, 1931) raises this to subgeneric rank. It would belong to Pilsbry's third division of *Bulimulus* (nepionic whorls sculptured with vertical riblets). Pilsbry further proposes (op. cit.) a subgenus *Scansicohlea* (*Scansicochlea?*), which is conchologically near typical *Bulimulus* (s.s.), but differs by microscopic spiral striation without axial wrinkles. Further, this subgenus has a penial verge. Thiele (op. cit.) includes *Bostryx* Troschel as a subgenus of *Bulimulus* as did Pilsbry (Man. Conch. 10: 127). However, Pilsbry later (Man. Conch. 14, Classification and Index to Volumes 10 to 14, 1902) considers *Bostryx* a section of the first division (with smooth apical whorls) of *Bulimulus*.

It becomes necessary to erect a new subgenus of *Bulimulus* to contain the species under consideration.

Paeniscutalus, new subgenus of Bulimulus

Type: *Megalobulimus incarum* Pilsbry (Naut. 58: 29, 1944) = *Bulimulus incarum* (Pilsbry).

The conchological characters are as delimited in the type description, but with two nepionic whorls rather than one and two thirds. The color of the shell, with periostracum, is a uniform Mikado brown to orange cinnamon with a scarcely per-

ceptible peripheral band (width, one mm.) of a somewhat darker brown bordered by indistinct broader bands (width, 1.5 mm.) of clay color. The peripheral band passes above the suture on the penultimate whorl. The brown of the shell fades to cinnamon buff at the peristome. (Colors from Ridgway.)

The conchological characters place *Bulimulus* (*Paeniscutalus*) *incarum* (Pils.) in the second division of the genus *Bulimulus* (s.l.). The radula of *B. incarum* (Pils.) consists of 119 transverse rows of teeth with the formula 34 : 1 : 34. The central tooth is tricuspid. All the laterals are bicuspid (fig. 9). The central tooth of the specimen figured has a length of 58.5 microns, and a width of 31.5 microns. The first lateral has the same length, but is 34.2 microns wide. The teeth figured are the central (C), and first (1), tenth (10), twentieth (20), and thirtieth (30) laterals as indicated (fig. 9). (*Plectostylus* has 101 teeth in a transverse row with only the inner 14 laterals bicuspid and the remainder tricuspid. In *Scutalus*, no ectocones occur on the central or the inner laterals. The ectocone appears at about the 18th lateral.) The radular characters approach typical *Bulimulus* (s.s.).

The shell is decidedly distinct from typical *Bulimulus* (s.s.), being ovate rather than cylindric, and larger than any typical *Bulimulus*. The five adult shells in this lot have the following dimensions, which are all smaller than the type and paratype:

Whorls	Height in mm.	Major Diameter in mm.
4.4	27.1	16.8
4.3	24.0	14.6
4.4	25.9	14.6
4.1	22.3	15.6
4.1	22.3	14.0

The pallial complex of *Bulimulus incarum* (Pils.) (fig. 6) is typically bulimuloid. The kidney is equilaterally triangular with the length equal to the length of the pericardium. The reflected ureter (sigmurethrous) is a closed tube throughout its length, and opens into a triangular urinary chamber within the pneumostome. Visible venation is confined for the most part to the region between the hindgut and the kidney and pulmonary vein. The pulmonary vein receives a complex of

heavy veins in the immediate vicinity of the pneumostome (somewhat obscured in the figure by the mantle collar). Two distinct veins lie to the left of the pulmonary vein, and roughly parallel it. The one nearest the pulmonary vein is a branch of the lateral sinus, and extends from the anterior margin of the lung to a point just short of the kidney. The other is the pericardial vein, which extends from the pericardium about half the distance to the anterior margin of the lung. Heaviest pigmentation (of very fine uniform dots) is from the pericardial vein to the hindgut. The reno-pericardial orifice is near the posterior end of the pericardium at about the center of the ventricle.

The mantle collar of this species (fig. 7) has the angulopalatal (a) and basopalatal (b) mantle lappets well separated. The parietal (p) mantle lappet rises from the left of the pneumostome (pn) and the angulopalatal rises from the right of it. A small parietal shell-lobe (sl) is present at the angle where the shell suture occurs.

The jaw (fig. 8) is composed of about 14 irregular plaits, not converging in the middle to form a triangular area. The jaw is green on the dorsal edge but changes to a golden yellow at the cutting edge. Normally the jaw is more arcuate than figured. The radula is of the helicid type with a pattern of very broad "Vs". It has a length of about 5 mm. and a width of 2 mm. (See above for teeth.)

The free retractor muscle system is characteristically bulimuloid. Three branches arise from the face of the columellar muscle. These are somewhat bound together for a short distance. One is the left ocular retractor, one is the buccal retractor (which bifurcates posterior to the buccal body), and the third is the right ocular retractor which passes through the penioviducal angle. The penial retractor arises from the center of the diaphragm about one third of its length from its apical end.

The salivary glands are lobulate and as long as the buccal mass. They are adnate to the oesophagus dorsally only (not forming a ring around the oesophagus), and are distinctly separate although bound together by connective tissue. The buccal

mass is ellipsoid, and the crop is distinct. From the jaw to the posterior end of the radular bulb is about 7 mm.

The genital system (figs. 1, 2, 3, 4, 5) is simple. The penial retractor is short and terminal. (In an immature specimen of 3.7 whorls, 17.5 mm. height and 12.8 mm. diameter, the retractor was longer, being a third as long as the penis and epiphallus together.) The vas deferens enters the epiphallus one third of the length below the apex of the epiphallus (base of epiphallic flagellum), which is one third to one half as long as the penis. The vas deferens is closely bound to the epiphallus and penis and passes through the muscular sheath at the base of the latter. The penis is somewhat swollen at the point where the epiphallus begins, but not distinctly so. Internal longitudinal plications of the penis and epiphallus are scarcely interrupted at the very slight constriction between them. (Figs. 5 are cross sections as indicated.) The spermatheca is irregularly longitudinally plicate within, about as long as the penis, and (in situ) closely bound to the oviduct. About one third of its length above the atrium, it swells to twice the diameter of the lower part. The distal end does not pass over the aorta and lay near the heart. There is no vagina; the spermatheca opens directly into the atrium as in typical *Bulimulus* (s.s.). The ovotestis consists of fan-shaped alveoli (fig. 4) imbedded in the middle three fifths of the liver. There is a seminal vesicle (and ovisperm duct) leading to the carrefour which is one third the length of the albumen gland and imbedded in it. (Fig. 2 is a lateral view of the carrefour separated from the albumen gland.) There is no talon present. Below the albumen gland the uterus and prostate gland descend together for a distance equal to the length of the penis. (Fig. 3 is a cross section as indicated.) A seminal groove cannot be distinguished. The free oviduct is short with the vas deferens adnate to it to the base of the penial muscle sheath under which its passes. There is no oviducal gland as there is in the genera *Plekocheilus* and *Auris*. (Cf. H. B. Baker, 1926, Occ. Pap. Mus. Zool., Univ. of Mich., No. 167.)

Dr. Bequaert, in correspondence, suggested that *Bulimulus incarum* (Pils.) might be a synonym for *Bulimulus crenellus* Philippi. Unfortunately there is no material of *B. crenellus*

Phil. available for comparative purposes. Though the material agrees with Philippi's description for the most part (in Malak. Blätter, 1867, xiv, p. 67), there are some discrepancies. Philippi says of *B. crenellus* "tenui" and "peristomate expanso, subreflexo," but *B. incarum* (Pils.) is not thin, and the peristome is but very slightly expanded. Philippi further says of *B. crenellus* "columella fere perpendiculari," but *B. incarum* (Pils.) has a strongly concave columella. *B. crenellus* Phil., as figured by Pfeiffer (Nov. Conch., 1867–1869, iii, Pl. 81, figs. 17–18), resembles *B. incarum* (Pils.) except for its straighter columella. This figure also shows the length of the aperture as about half the shell length, whereas in *B. incarum* (Pils.) the aperture is nearly two thirds the length of the shell. Philippi's description gives, "Long. 27, lat. obliqua (i.e. suturae parallela) 16 mill.; apert. 15 mill. alta, 8 lata." Since Philippi's description lacks any anatomical detail and description of the nepionic sculpture, *B. incarum* (Pils.) might be left as a specific entity, which it probably is.

EXPLANATION OF FIGURES 1 TO 9

Bulimulus (*Paeniscutalus*) *incarum* (Pils.). Fig. 1, Genitalia. Fig. 2, Lateral view of carrefour and kidney. Fig. 3, Cross section of uterus and prostate gland. Fig. 4, Alveoli of ovotestis. Fig. 5, Cross sections of penis. Fig. 6, Pallial complex. Fig. 7, Mantle collar, (a) angulopalatal mantle lappet, (b) basopalatal mantle lappet, (p) parietal mantle lappet, (pn) pneumostome, (sl) shell-lobe. Fig. 8, Jaw. Fig. 9, Teeth, (c) central, (1) 1st lateral, (10) 10th lateral, (20) 20th lateral, (30) 30th lateral.

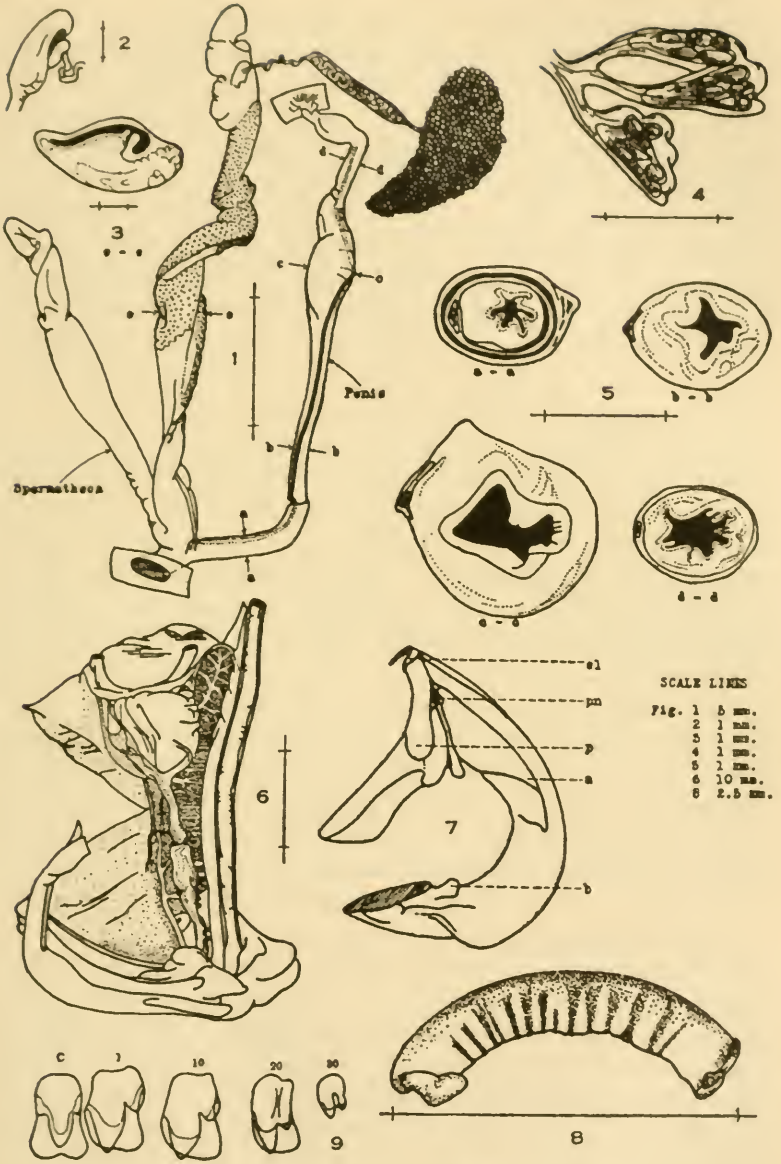
CYPRAEA CERVINETTA KIENER AND CYPRAEA ARABICULA LAMARCK

By WILLIAM MARCUS INGRAM
Mills College, California,

AND

HAROLD TRAPIDO
Gorgas Memorial Laboratory, Panama

The included data add information to the little recorded observations on the natural history of the Cypraeidae. Six mature



Bulimulus (*Paeniscutalus*) *incarum* (Pilsbry).

See p. 16.

individuals of *Cypraea cervinetta* Kiener and three of *Cypraea arabicula* Lamarck were collected alive at San Francisco de Caleta, a suburb of Panama City.

The collections were made at an area where an outcroping of sea-eroded volcanic rock extends to seaward. Here there is a maximum tide fluctuation of about twenty feet so that an extensive intertidal zone of several hundred feet is present. At low tide, there are numerous tide pools in the area where certain mollusks and fish are trapped or quite naturally remain when the tide is out. The cowries referred to above were taken at the front of the low tide zone where they were either attached to rocks, or in pools mostly washed by waves even at low tide. Little or no sand is present in the area and the surf is light.

The six individuals of *C. cervinetta* Kiener show quite a variation in size, varying from 91 mm. in length to 46 mm. in width to 36 mm. in height to 61 mm. by 32 mm. by 26 mm. The intermediate stages measure with length, width, and height given respectively in millimeters: 77 + 40.5 + 31.80, 76.5 + 38 + 31, 74 + 37 + 39, 71 + 37 + 28. The three individuals of *C. arabicula* Lamarck measure: 29.5 + 19.5 + 15, 29 + 20 + 15, 29 + 18.8 + 14.

Cypraea arabicula Lamarck ranges from Mazatlan, Acapulco, Mexico, to Cape San Lucas, Lower California, to Corinto, Nicaragua, to Punta Dominical, Costa Rica, to Panama, to the Galapagos Islands. It has been listed as a Pleistocene fossil from Magdalena Bay, Lower California, by Jordan (1936); and from the upper Pleistocene of Oaxaca, Mexico, by Grant and Gale (1931) and by Palmer and Hertlein (1936).

Cypraea cervinetta Kiener is confined to the West Coast of the Americas although without doubt it is closely related to two Caribbean species, *Cypraea cervus* Linnaeus and *Cypraea zebra* Linneaus. *C. cervinetta* ranges from Guaymas, Mazatlan, and Mendia (Sinaloa), Mexico, to La Paz and Cape San Lucas, Lower California, to Panama, to Cardalitos, Peru, to the Galapagos Islands. A young specimen, *Cypraea aff. cervinetta*, is recorded by Dall and Ochsner (1928) from the Pliocene of Seymour Island, Galapagos Islands.

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A NEW SPECIES OF NATICARIUS FROM FLORIDA[1]

By HARALD A. REHDER

We have recently received from Mr. Frank Lyman two specimens of an interesting *Naticarius* from Marco Island, west Florida, which appears to be undescribed. This is remarkable not only because of the size of the shell, but also because it comes from a region which has been fairly well explored for many years. All evidence points towards the fact that this is an authentic record, and it leaves me no alternative but to describe this as new, in spite of the fact that neither shell has the operculum. Mr. Lyman informs me that Mr. Harold Post of Chesterfield, New Hampshire, collected two additional specimens at the same place, also without operculum.

Naticarius verae, **new species.** Plate I, two upper figures.

Shell of medium size for the genus, similar in form to *Naticarius canrena* (Linné). Nuclear whorls worn, somewhat smooth, of an opaque-glassy color; first postnuclear whorl pale brownish, antepenultimate and penultimate whorls are light bluish gray in color. Last whorl with several spiral zones of color arranged as follows: A narrow subsutural white band, which is present from the first postnuclear whorl onwards, is

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followed by a moderately broad band of a maize yellow color; below this is a band twice as broad of a vinaceous pink color, somewhat darker in the upper part; just below the periphery is a narrow whitish band, with a very faint yellowish overcast; between this and the broad white umbilical area is a moderately broad band of the same color as the broad band above, but slightly darker. The two darker bands are faintly and irregularly axially streaked with darker color, and there are often obscure and irregular spiral color lines.

Pronounced retractively slanting grooves run down from the suture, as in *N. canrena*, and the umbilicus also is similar to that in *N. canrena*, moderately broad, with a strong funicle. The operculum is unknown.

The type, U.S.N.M. No. 485562, measures: Height, 27 mm.; greatest diameter, 25.5 mm. It was collected by Mrs. Frank Lyman on Marco Beach, Marco Island, Collier County. A slightly larger but more worn paratype is entered in our collection as U.S.N.M. No. 485563.

This shell seems to be closely related in general aspect to *Naticarius canrena* (Linné), differing of course, markedly in its color pattern, and I am placing it in *Naticarius* with very little hesitation, even though we do not have an operculum. It is named for Mrs. Frank Lyman.

ACELLA HALDEMANI IN ONTARIO, CANADA

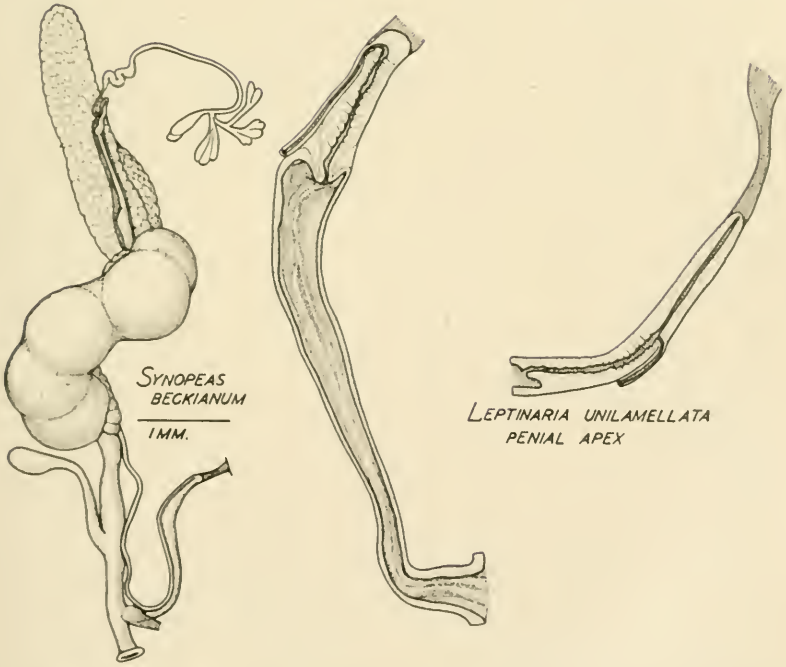
By H. B. HERRINGTON
Newburgh, Ontario

Acella haldemani Deshayes is one of our rarest and most graceful shells. Its scarcity has precluded the accumulation of information on its life history. The purpose of the present author is to record observations and comments on this snail in Ontario.

GENERAL DISTRIBUTION: Baker (1928) says, "Vermont and eastern Ontario west to Northern Minnesota, south to Northern Illinois and Ohio."

DISTRIBUTION IN ONTARIO: Mr. Aurele LaRocque writes me as follows (Feb. 14, 1947), "There is an old, erroneous record of this species for the Rideau River, near Ottawa, Ont. . . . I

Naticarius vernae Rehder (p. 19).



Synopeas beckianum (Pfr.): Dissected genitalia and optical longitudinal section of penis. *Leptinaria unilamellata* (Orb.): penial apex. (See H. Burrington Baker, 1945, Naut. 58: 91.)

left it out of my account of the Mollusca of Ottawa (Can. Field-Nat. 52: 115)." And again (Feb. 21, 1947), "As to the Ottawa record: the locality is given exactly by Heron; and Latchford, Mr. Fairbairn, Mr. C. E. Johnson and I have repeatedly combed the Rideau River at Billings' Bridge for this species, without success. Someone, I think Latchford, thought that Heron mistook some young *Lymnaea stagnalis jugularis* for *A. haldemani*. The *Lymnaea* is still abundant at Billings' Bridge . . . if *Acella haldemani* ever was found at Billings' Bridge, I can assure you that it no longer lives there, nor anywhere else in the Ottawa region. I have combed the Rideau River and Canal many times in the last 15 years, as well as the Ottawa and many of the lakes of the region, and *Acella haldemani* is one species I have never found. Hence, I felt justified in dropping it from my account of the mollusca of Ottawa, but I see that I did not call attention to the fact that I was doing so, nor did I state my reasons for this action." (Printed with Mr. LaRocque's permission.)

There are no records in the Royal Ontario Museum of Zoology of this snail from Northern Ontario.

COMMENTS ON HABITAT: Goodrich (1932) remarks, "The only detailed account of the collecting of this *Lymnaea* has been written by Dr. Raynold J. Kirkland of Grand Rapids, and it is herewith reprinted." The account shows that Dr. Kirkland collected this snail at Reed's Lake on Thanksgiving Day, 1897, and that the surface of the water was covered "with a thin sheet of ice not thick enough to interfere with wading." Kirkland's statement continues, "This is a deep water species, which migrates shoreward in the fall, doubtless for spawning purposes, as adults only have been captured, but this should be verified by dissection. September 25th is the earliest date that they have been taken, and they remain until ice forms, how much longer is not known. They are gregarious, or at least live in colonies. This colony has occupied an area of not more than a few square rods any one year; and the location of this area has not varied a hundred feet in either direction during the ten years of its observation. . . . The home of this mollusk is on the rushes or reeds common to all our inland waters; in water from one to three feet deep; and invariably from six to eight inches from the bottom, on the side of the reed facing deep

water, the apex of the shell pointing downwards—though in a few instances the apex has been upwards, as if in the act of descending. . . ."

Robertson (1915) comments, "*L.* (*Acella*) *haldemani* (Deshayes) Binney; Found on the lower surface of lily-leaves in well-sheltered muddy bays in late summer. Observed in but two situations, both of which were removed from open water and were especially well-protected. Several specimens secured in each situation. Diligent search failed to reveal any during the early summer and nothing was found to indicate their habitat during this period. These observations agree in their main features with Kirkland's account as given by Baker ('11). Those secured were, however, considerably removed from deep water; none were observed in the approaches to the bays, neither were any secured in dredging. . . ."

(a) The present writer has found this snail in shallow water only. In three places (Bay of Quinte at the Carrying Place, Mississippi R. at Mazinaw L. and at Ervin's L.; see summary.) I found it in shallow water where deep water was close at hand. But, on the other hand, I found empties in Mud Lake (see summary) where there is no deep water for half-a-mile. This lake is filling in so that much of it cannot be navigated even with a row boat until the fall rains come. And, yet, here I found an empty, the largest on record—Goodrich says, "an extreme size of 25 mm.," but this one had a length of 29 mm.

But more conclusive proof that some, at least, of these snails do not require deep water was found in 1946. Having found live specimens in a shallow enlargement of the Mississippi River about ½ mile above Mazinaw Lake I went on a further search up-stream on Aug. 1, 1946, and at the entrance of Mallory Creek among the weeds on a sandy shore, in water 0 to .75 meters, I found three live infants. This station is three miles below Macavoy Lake and almost one mile above Mazinaw Lake, and fully ¼ mile above the enlargement referred to above. It seems out of the question for these snails to get to deep water and then back again.

(b) I found these snails only where there are rather coarse grasses and pond lilies where they have something solid to which to cling. I did not find them on fine or soft weeds and grasses.

Furthermore I found that these snails have a preference for weeds which grow on a sandy or soft sand bottom, although a muddy bottom was at hand if they so desired. I have picked them from grass and weeds including the pond lily (yellow) a few inches from the bottom. I have never found live specimens, by dipping or otherwise, where the bottom is real muddy. I have found them where the mud begins to pass over into sand.

(c) The three live adults collected at the Carrying Place, Bay of Quinte, on April 19, 1945, appear as mature as the empties. The one live adult collected at Ervin's Lake, July 10, 1945, was also mature and had much the same appearance as the above.

I would like to emphasize that I have found infants at six different stations in one drainage system (see summary) and in every case they were in shallow water. This would indicate that breeding takes place where the water is shallow. Furthermore, the smallest live specimen secured (3.3 mm.) was found at Ervin's Lake, July 10, 1945, and no infants were found at the Bay of Quinte, Carrying Place, April 19, 1945. This would indicate that the hatching of these snails takes place in late spring.

Let me point out in addition to what is stated in (a), which shows that my experience with these snails differs from Kirkland's in the matter of their seeking deep water, that although there is nothing to show that *Acella haldemani* may not, in some localities, seek deep water for part of the year we have no record of live specimens ever having been taken in deep water. I took two badly bleached fragments at a depth of 3.5 meters, in ooze, in the Bay of Quinte at the Carrying Place, Sept. 25, 1945, but they may have been carried there by an off-shore current. (On April, 1945, I found this shore strewn with small clams and snails, alive and dead. On April 4, 1946, I visited the same locality and there was not a shell of any description to be found —currents are temperamental.)

In collecting in Ervin's Lake I found these snails in numerous spots. In other spots, for no apparent reason, I could find none. It may quite well be that they live in colonies.

SUMMARY: *Acella haldemani* appears to be a scarce sporadic species in Ontario where it is known from Lake Erie, Lake Ontario north to Georgian Bay and the head-waters of the Mississippi River of the Ottawa River drainage.

A summary of the known Ontario records of *Acella haldemani* follows:

Lake Huron. Georgian Bay, R. O. M. Z. number 1812–1817, 6 lots, comprising 26 shells, L. 12.0 to 19.5 mm., A. D. Robertson! Manitoulin Is. (Georgian Bay end?), U. of Mich. number 75579, 4 shells, lengths 14.5 to 17.5 + mm. (apex broken): fresh, A. D. Robertson!

Lake Erie. *Norfolk County,* Long Point, June 11, 1927, fragment of dead shell, Dr. E. M. Walker!

Lake Ontario and drainage. *Wentworth Co.,* Hamilton Bay, Nov. 24, 1889, "Nearly 150 specimens taken, Nov. 24, on Carroll's Point, thrown up in driftweed after storm." A. W. Hanham! A lot of 34 shells in the Hanham collection of the R. O. M. Z. apparently is the remnant of that gathering. Their lengths range from 14.6 to 27.0 mm. *York Co.,* Meads ("Meads" was an old hotel on Center Is. on the bay side. Water shallow), Toronto Bay, Chief Justice Latchford! (The author collected the shells of the balance of these records.) *Hastings Co.,* small creek 2½ miles south of Tweed, a bleached shell from post-Pleistocene marl. *Lennox* and *Addington Co.,* Camden Twp., Mud Lake, Oct. 12, 1942, dead shells, longest 29.0 mm. Boundary of *Northumberland Co.* and *Prince Edward Co.,* Carrying Place, Bay of Quinte, Apr. 19, 1945, at least 3 living, lengths: 17.5 mm. with 4¼ whorls to 20.0 mm. with 4½ whorls, about 85 empties, depth 0 to .75 meters. *Prince Edward Co.,* Outlet of Spence L. into L. Ontario, June 11, 1945 and June 10, 1946, 2 lots, 4 empties.

Ottawa drainage. *Lennox* and *Addington Co.,* Abinger Twp., Mississippi R. (mouth of river about 40 miles above city of Ottawa), 0 to ¾ mile above Mazinaw Lake, July 20, 1944 to Aug. 1, 1946, 3 lots of live infants and a few empties, 0 to 1 meter of water; one lot has two hatchings, (a) 7 shells, L. 10.5 to 12.2 mm., (b) 5 spns., L. 7.0 to 8.5 mm.; another of these lots also has two hatchings, (a) 2 specimens, L. 10.0 and 11.6 mm., (b) 1 spn., L. 5.6 mm. Abinger Twp., Ervin's L., at headwaters of the Mississippi R., July 25 and 27, 1944, several living, mostly infants. July 10 and 16, 1945, 10 empty, 35 live infants, 4 live adults, lengths of living shells: 3.3 mm. with 2½ whorls to 23.0 mm. with 4½ whorls.

The record number 75579, A. D. Robertson!, is from the University of Michigan, Ann Arbor, Mich., is part of the Bryant Walker collection, and is published through the courtesy of the Curator of Mollusks, Dr. Henry van der Schalie. The other

records for Robertson and for shells collected by Dr. E. M. Walker, A. W. Hanham and Chief Justice Latchford are derived from shells in the Royal Ontario Museum of Zoology, Toronto, Ont. (catalogue nos. refer to that collection), through the kindness of the director, Prof. J. R. Dymond, and from published accounts.

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NOTES ON THE GENUS PROBYTHINELLA (HYDROBIINAE)

By J. P. E. MORRISON [1]

Associate Curator, Division of Mollusks, United States National Museum

Some time ago the writer began a search through the specimens of Amnicolidae contained in the United States National Museum collections for all material belonging to the genus *Fontigens*. In the course of that search, the small species described at *Paludina obtusa* Lea, 1844, was found not to be the same as that commonly called *Probythinella emarginata* (Küster), 1852. Since Bryant Walker in 1901 (Nautilus 15: 30) thought they were identical and united them, apparently no one up to the present has critically re-examined Lea's types (U.S.N.M. No. 121394).

This writer's personal field acquaintance with the ecological habits of the genus *Fontigens*, from springs and other similar

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cold-water habitats, in contrast with those of *Probythinella,* from the bottom of deeper waters in the Great Lakes region, and our larger rivers, has only served to accentuate the shell differences seen in these two species, that have hitherto been confused.

Paludina emarginata Küster, 1852, is not synonymous with, nor even congeneric with *Paludina obtusa* Lea, 1841, which was preoccupied by *P. obtusa* Troschel, 1837. The name proposed by Hannibal (Proc. Mal. Soc. London, 10: 190, 1912) cannot be used in *Probythinella* because he stated definitely that he was renaming Lea's species. Hannibal's name is valid for *P. obtusa* Lea, a distinct species, of which the correct name is *Fontigens binneyana* (Hannibal).

The genotype of *Probythinella,* at least the typical or widespread form of the species, is thus left without a valid name.

PROBYTHINELLA

Probythinella Thiele, 1928, Zool. Jahrb. 55: 369–370; genotype *Cincinnatia (P.) emarginata* (Küster) = *P. lacustris limafodens*, nomen novum, by monotypy.

Vancleaveia F. C. Baker, 1930, Trans. Ill. State Acad. Sci. 22: 189–192; genotype *V. emarginata* (Küster) by subsequent designation of Pilsbry, 1934, Proc. ANSP. 86: 562, footnote.

In this footnote, Pilsbry mentions only one specific name of the three originally included by Baker, and states that this species [*P. emarginata* Küster] is the genotype of both *Probythinella* and *Vancleaveia.* They are thus nomenclatorially equivalent by isogenotypy. Although the name *Vancleaveia* was actually proposed in manuscript in 1928 by the late F. C. Baker, it is necessarily a synonym because it was inadvertently delayed two years in the process of publication. The subsequent statement of Berry (*loc. cit.,* p. 40, 1943) concerning an original genotype designation by Baker is incorrect. It is also invalid, being subsequent to the designation by Pilsbry in 1934.

To briefly review the nomenclature and synonymy of the specific names: The name *Paludina emarginata* Küster, 1852, was based on a manuscript or specimen name, *Lymnaeus emarginatus* Say, according to Bronn, in Küster's synonymy. Since Küster did not state that he was renaming the species, it may be convincingly argued that the synonymy is the only indication of the source of this name *L. emarginatus.* If this be true, it was a

homonym of *Lymnaeus emarginatus* Say, 1821, and preoccupied by it. Hence the name *L. emarginatus* cannot be used for the species that was described and figured for the first time in 1852 by Küster.

The first valid name for this species is that proposed for one of its varieties, namely *Probythinella lacustris lacustris* (F. C. Baker). The northern form will be known as *P. lacustris canadensis* (F. C. Baker). The more widespread "typical" form of the species may be known as *P. lacustris limafodens*, nomen novum.

PROBYTHINELLA LACUSTRIS LACUSTRIS (F. C. Baker)

1928. *Cincinnatia emarginata lacustris* F. C. Baker, F. W. Moll. Wis. 1: 127, pl. 7, figs. 20–23, text figs. 54: 3, 4.
1930. *Vancleaveia lacustris* F. C. Baker, Trans. Ill. State Acad. Sci. 22: 191, figs. 2: 6–8, 11.
1943. *Amnicola* (*Probythinella*) *binneyana lacustris* Berry, Misc. Publ. Mus. Zool., U. of Mich., no. 57: 40.

Type locality: Lake Winnebago, near Oshkosh, Wisconsin.

PROBYTHINELLA LACUSTRIS CANADENSIS (F. C. Baker)

1928. *Cincinnatia emarginata canadensis* F. C. Baker, F. W. Moll. Wis. 1: 130, text figs. 54: 7, 8.
1930. *Vancleaveia emarginata canadensis* F. C. Baker, Trans. Ill. State Acad. Sci. 22: 191, figs. 2: 3–5, 10.
1943. *Amnicola* (*Probythinella*) *binneyana canadensis* Berry, Misc. Publ. Mus. Zool., Univ. Mich., no. 57: 40.

Type locality: Lake Kakiska near mouth of Beaver River, west of Great Slave Lake, about latitude 61° N., Mackenzie District, Canada.

PROBYTHINELLA LACUSTRIS LIMAFODENS, **Nomen Novum**

1852. *Paludina emarginata* Küster, Conch. Cab., edn. 2, Paludina, p. 50, pl. 10, figs. 3, 4. (Name invalid; based on and preoccupied by *Lymnaeus emarginatus* Say.)
1863. *Amnicola emarginata* Frauenfeld, Verhandl. Zool. Bot. Ges. Wien, 13: 1030.
1865. *Paludina emarginata* Binney, L. & F. W. Shells, N. A., 3: 85, fig. 169.
1870. *Bythinella obtusa* Tryon, Cont. Hald. Mon., pp. 48–49 (non p. 78, q.e. *P. obtusa* Lea).
1870. *Bithinella obtusa* Tryon, Cont. Hald. Mon., pl. 16, fig. 6.
1898. *Cincinnatia obtusa* F. C. Baker, Moll. Chicago Area, 1, pl. 26, fig. 10.

1901. *Cincinnatia emarginata* Walker, Nautilus, 15: 30 (except *Paludina obtusa* Lea).
1902. *Amnicola* (*Cincinnatia*) *emarginata* F. C. Baker, Moll. Chicago Area, 2: 336–7.
1912. *Cincinnatia emarginata* Hannibal, Proc. Mal. Soc. London, 10: 190 (non *P. obtusa* Lea, et non *C. binneyana* Hannibal).
1918. *Amnicola emarginata* Walker, Misc. Pub., Mus. Zool., U. of Mich., number 6: 136 (non *P. obtusa* Lea, et non *C. binneyana* Hannibal).
1928. *Cincinnatia emarginata* F. C. Baker, F. W. Moll., Wis., 1: 126, figs. 54; 1, 2 (except *P. obtusa* Lea).
1928. *Cincinnatia* (*Probythinella*) *emarginata* Thiele, Zool. Jahrb., 55: 369–70.
1929. *Hoyia* (*Probythinella*) *emarginata* Thiele, Handb. Syst. Weichtierkunde, 1: 140, fig. 115.
1930. *Vancleaveia emarginata* F. C. Baker, Trans. Ill. State Acad. Sci., 22: 191, figs. 2; 1, 2, 9.
1934. *Probythinella emarginata* Pilsbry, Proc. ANSP, 86: 562 (except *P. obtusa* Lea and *C. binneyana* Hannibal).
1939. *Hoyia* (*Probythinella*) *emarginata* Wenz, Handb. Paläozool., 6 (Gastropoda) (3): 569.
1939. *Probythinella emarginata* Wenz, *ibid.*, p. 569, fig. 1538.
1943. *Amnicola* (*Probythinella*) *binneyana* Berry, Misc. Pub., Mus. Zool., U. of Mich., number 57: 36 (except *P. obtusa* Lea).

Type locality: North America.

This name is given to describe its normal habit of burrowing about one quarter inch beneath the surface of the mud in deeper water (10–20 ft.) of lakes and streams. Hundreds of specimens of *P. l. limafodens* collected personally from the Jackson Park (Chicago) Yacht Lagoons in 1934 show a definite relation of size of individuals to type of bottom habitat. Those burrowing in soft mud bottom were visibly larger than those from (muddy) sand bottoms. This observed size difference of individuals from populations only a few hundred feet apart is probably due to greater availability of food materials in the muddier bottoms, with less disturbance of activity by waves and currents in the water.

NOTES ON THE PHILIPPINE SNAIL, VIVIPARUS BURROUGHIANUS LEA

By J. P. E. MORRISON [1]

Associate Curator, Division of Mollusks, United States National Museum

Recent receipt at the U. S. National Museum of specimens from Luzon containing the animals has made possible the clarification of a puzzling report on the biology of this snail, sometimes called *V. angularis*. Bryant Walker in 1919 (Nautilus, 32: 120) ably clarified the taxonomic position of this and other Philippine species of *Viviparus*.

Chang in 1929 (Peking Soc. Nat. Hist., Bull. 3 (4): 45–57) described and figured the anatomy of the common species, *Viviparus sinensis* from Peking, China. The reproductive anatomy of this Chinese species as shown by Chang is in complete agreement with that of European, Indian, Chinese, and American species as reported by Baudelot (Ann. Sci. Nat., 19: 79–86; 1863), Annandale & Sewell (Rec. Ind. Mus., 22: 215–292; 1921), Li (Chinese Journ. of Zool., 1: 18: 1935), Stimpson (Smith. Misc. Coll., number 144: 16–17: 1865), and Van Cleave and Lederer (Journ. of Morph., 53: 499–522; 1932). The dioecious mode of reproduction of the genus was also confirmed by this writer in 1933, in dissecting more than a thousand individuals of *Viviparus contectoides* from Illinois.

The statement by Alonte (The Philippine Agriculturist, 19 (5): 307–325; 1930) that *Viviparus burroughianus* Lea is hermaphroditic, is unfortunate. No hermaphroditic members of the family Viviparidae are known. In the case of the American genus *Ambloxis*,[2] the observations of F. C. Baker (F. W. Moll. Wis., 1: 61, 69, 75; 1928) and of the writer, and the cytological proof furnished by Mattox (Journ. of Morph., 62: 243–257; 1938) indicate parthenogenesis without any change in the gross anatomy of the female, from the condition present in normally dioecious species of the family. It seems inconceivable that

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[1] Published by permission of the Secretary of the Smithsonian Institution.

[2] For a full discussion of the case of *Ambloxis* Raf., 1818, vs. *Campeloma* Raf., 1819, see: Pilsbry, Nautilus, 30: 111, 1917.

hermaphroditism could occur in the Viviparidae without any duplication of gonads or ducts in the individual.

Chang (*l.c.*) states that sperm may be found living actively in the oviduct of the female throughout the year. Alonte (*l.c.*) likewise found sperm present, but erroneously assumed they were produced by the females he examined. Alonte's experimental snails were not isolated sufficiently; they were not isolated from any "wild" snails that chose to crawl on the outside of the baskets used as rearing containers. Coitus probably occurred through the meshes of these baskets, left for three months in the normal habitat of the snails in Laguna de Bay.

Examination of fresh material including the animals of *V. burroughianus* received for identification at the U. S. National Museum from medical members of our armed forces studying fluke diseases in the Philippines, has confirmed the normal dioecious reproduction method for this species. Of one lot of 26 specimens, 11 were found to be male and 15 were female. As in other members of the genus *Viviparus* personally examined, the males were smaller than females of the same age. This is undoubtedly due in part to the fact that the males grow very slowly after reaching maturity in the first year. In the case of *V. contectoides* personally examined for growth ring studies, three-year-old males are but little larger than those one year old, while the females are proportionately larger in their second and third years.

In summary, all known members of the family Viviparidae possess reproductive structures according to the dioecious plan. The only deviation from the normal dioecious reproduction known (in certain species of *Ambloxis*) is the absence of male individuals from the species, with reproduction continuing in the 100% female population by parthenogenesis.

NOTES AND NEWS

THE PLANORBID GENUS ARMIGERUS.—Clessin, in his Monograph of the genus *Planorbis* [Conch. Cab. Martini-Chemnitz, edn. 2, I (17) : 120, 1884], published the name *Armigerus* for the species *Planorbis albicans* Pfr., 1839, and *P. alexandrinus* Ehrenberg,

1831. *Planorbis albicans* Pfr., 1839, type locality near Cardenas, Cuba, is hereby designated the genotype, because it is the first species, on which the description of the name was principally based, and because Clessin stated on page 121 that *P. alexandrinus* Ehrenberg "also" belonged to the section.

Armigerus Clessin, 1884, will thus displace *Obstructio* Haas, 1939, the two being completely synonymous. *Tropicorbis* Pilsbry & Brown, 1914, and *Lateorbis* F. C. Baker, 1945, may be retained as subgenera as considered by Baker (Planorbidae, p. 85, 1945). The second species included, *P. alexandrinus* Ehrenberg, is a member of the genus *Afroplanorbis* Thiele, 1931, according to our present knowledge.

It is unfortunate that *Armigerus* has been apparently overlooked by every cataloguer of generic names and by every student of the Planorbidae from the time of its publication to date. It is increasingly important to correct the name of this group of planorbid snails now, to prevent undesirable later changes in the literature of medical research into the problems of African schistosomiasis.—J. P. E. Morrison.

A new name for a west American Cyclostrema.—Recently C. G. Aguayo (Rev. Soc. Malacol. "Carlos de la Torre," Vol. 4, No. 3, December, 1946, p. 91) pointed out that the combination of names *Cyclostrema bartschi* proposed by Strong & Hertlein (Allan Hancock Pac. Exped., Vol. 2, No. 12, August 21, 1939, p. 240, pl. 21, figs. 12, 13, 16) for a species described from Bahia Honda, Panama, had already been used by Mansfield (Florida State Geol. Surv., Bull. No. 3, 1930, p. 132, pl. 20, figs. 13, 14, 15) for a species from the upper Miocene of Florida. The **new name** *Cyclostrema veleronis* is here proposed for the species described by Strong and Hertlein in 1939.—A. M. Strong and L. G. Hertlein.

Type of Pseudantalis Monterosato, 1884, Nom. Gen. e Spec. Conch. Medit., p. 32, was not stated in original publication, and I believe not elsewhere. *Dentalium fissura* Lamarck is now designated type.—Pilsbry.

Strombus gigas verrilli.—Further collecting at various stations, through the past summer and fall, has permitted me to extend the range of this subspecies. It is now known to occur from Ft. Pierce, St. Lucie County, southward as far as Key

West, in Florida. Occasional Bahaman specimens have been observed in local curio shops, but the extent of its West Indian distribution is as yet unknown.—Thomas L. McGinty.

Additional Strombus samba (Clench) from Florida.—During the past month, I have collected two additional specimens of *Strombus samba* in Lake Worth. Both were living, and measure 155 and 197 mm. in length. I have also collected a very ancient shell of *S. samba* in a semi-fossil state, partially embedded in coquina, which would seem to indicate that this species has inhabited Lake Worth for a very long period of time.

I have also obtained a number of specimens of *Strombus pugilis alata* from a colony discovered in Lake Worth. This, I believe, is the first report of this shell on the Florida east coast.—A. Hyatt Verrill.

On the term "albino."—The informative article by D. S. and E. W. Gifford on *Olivella undatella* in The Nautilus (1947, 60: 81–84) raises the question of the meaning of "albino" in mollusks. The authors do not actually define their usage but, by inference, it is applied to shells without evident ground color and with little or no brown markings and yellow wanting or restricted to the fasciole. Such a definition is not in accord with the use of the term "albino" in other groups of animals where albinos are strictly devoid of all pigments except respiratory pigments such as haemoglobin. The authors do not demonstrate that the immaculate white shells are albino since they do not show want of pigment in the soft parts of the animal. I suggest that the term be used only when there is clear proof of want of pigmentation.

The great progress made in the last quarter century in the chemistry of natural pigments, especially carotenoids and porphyrins, should make it now possible to work out a reasonably good synopsis of molluscan coloration. As a guess, I would conclude that *Olivella undatella* contains three classes of pigments: (1) gray and brown (perhaps melanins), (2) yellow (perhaps carotenoid), (3) chocolate and purple.

It is rather suggestive that using these three classes as independent items in the coloration, we find the same approximate ratios of presence and absence:

gray and brown : non-gray = 3:1
yellow : non-yellow = 3:1
chocolate and purple : non-chocolate = 3:1

As a preliminary hypothesis, I submit that there are three major independent pairs of alleles involved as above and that there are a number of modifiers for each pair. The 2117 different colored shells could be accounted for by a maximum of nine pairs of modifying alleles. These modifiers might determine depth or minor changes in hue, pattern, etc.—CHARLES H. BLAKE, Mass. Institute of Technology.

ADELOPOMA COSTARICENSE FOUND IN CHARLESTON, S. C.—A specimen of what seems to me to be the Costarican species *Adelopoma costaricense* Bartsch and Morrison was taken alive in Charleston, S. C., on April 12, 1945, by my younger colleague at the Chicago Natural History Museum, assistant curator of insects Rupert L. Wenzel, then a captain in the U. S. Army. It fully corresponds with the shell characters attributed to this species of cyclophorid land snails, the only difference being that our specimen (CNHM. No. 24510) is of a buff color all over, whereas, according to the description given by Bartsch and Morrison (U. S. Nat. Mus. Bull. 181, p. 150; 1942), the species is generally alabaster white.

The collecting history of the specimen in question offers a certain interest inasmuch as it was found in a light trap for insects set near the edge of a marsh on the grounds of the wartime Stark General Hospital, in the northwestern outskirts of Charleston. Whether the little snail went into this trap on its own or whether it was carried there by some larger flying insect to which it clung, cannot be decided. The latter of the two alternatives is by no means as improbable as it might appear, for I have already experienced another case of such a passive dispersal, that of the southwest European acmid shell *Renea moutoni* Dupuy sticking to a leg of a large bee caught while flying in the air.

From the only specimen of *A. costaricense* found alive in Charleston, it cannot, of course, be concluded that this species is firmly established on American soil, though this is by no means impossible, if one considers the hot and damp climate of South

Carolina, in which so many imported tropical plants can exist. It was, perhaps, with such plants that our species, elsewise only known from Santa Maria, Costa Rica, has been unintentionally introduced into the Charleston area.—Dr. Fritz Haas, Curator of Lower Invertebrates, Chicago Natural History Museum, Chicago, Ill.

Cypraea spadicea Swainson in Lower California.—Information is included here to add a new locality and habitat data for the Nut-brown Cowry, *Cypraea spadicea* Swainson. Thirty-two living individuals were taken at Geronimo Island, Lower California on April 12, 1946. These were found in high tide pools on the southeast side of the island on a shelf which extends seaward from the bluffs of the island. The dominant animal in the pools was the sea urchin, *Strongylocentrotus* sp., which carpeted the sides of the tide pools. The cowries were taken under ledges and in old pockets made by sea urchins. *Mitra* species were also fairly abundant in the pools. The average length of thirty-two specimens was 46.99 mm. The largest specimen measured 54.10 mm. long by 31.75 mm. wide by 27 mm. high, and the smallest was 31.80 mm. long by 18.10 mm. wide by 14.90 mm. high.

Cypraea spadicea Swainson extends along Lower California as far south as San Roque. In the fossil state its southernmost record is in the Pleistocene of Magdalena Bay, Lower California, approximately 275 miles farther south than the southernmost living record. In the living state this cowry ranges north to Chinatown Point, Monterey Bay, California. Dall [1] lists the distribution of this species from Santa Barbara, California to Cerros (Cedros) Island, Lower California. Berry [2] reported the Monterey Bay, California northern record. Strong [3] lists it from from San Martin Island, Lower California. Ingram [4] reports it to be seemingly found in greatest abundance at San Diego, Laguna Beach, and San Pedro, California.

The writer wishes to thank Mr. Woodbridge Williams of La Jolla, California for supplying the thirty-two individuals and

[1] 1921, Bull. U. S. Nat. Mus., 112, pp. 1–217.
[2] 1908, The Nautilus, vol. 22, nos. 4–5, pp. 37–41.
[3] 1937, Proc. Calif. Acad. Sci., 4th ser., vol. 23, no. 2, pp. 191–194.
[4] 1938, The Nautilus, vol. 52, no. 1, pp. 1–4.

certain locality data.—William Marcus Ingram, Mills College, Calif.

Cepaea nemoralis in Boston.—Mr. Ernest J. Palmer, of the Arnold Arboretum, Harvard University, has recently sent me a set of the introduced *Cepaea nemoralis* (Linné) which he has discovered to be living in Jamaica Plain, Boston, Massachusetts. He found the shells under moist decaying twigs and leafmold in a vacant wooded lot in the 1000 block of Centre Street, Jamaica Plain.

An interesting fact about this colony is the large number of specimens with hyaline banding and white peristomes in this colony. Of the 26 shells in this sending, collected on October 5, 1946, 11 were of this phase. Following J. W. Taylor (Monograph of the Land and Freshwater Mollusca of the British Isles—Zonitidae, Endodontidae, Helicidae; 1914, pp. 287–321), the following color varieties and banding variations are present:

Var. *libellula* Risso	12345	11 specimens
Var. *libellula* Risso	00300	4 specimens
Var. *hyalozonata* Taylor	12345	8 specimens
Var. *hyalozonata* Taylor	00300	3 specimens

In this connection, the recent discovery of this species at New Market, Shenandoah County, Virginia, is considerably north of the other known colonies in Virginia.—H. A. Rehder.

Cassis tuberosa L. feeding on an echinoid (Clypeaster rosaceus L.)—Frank Lyman (1937, Nautilus *51*, 1, p. 34) has reported finding the spines of the sea urchin *Toxopneustes variegatus* Lam. in the digestive tract of *Cassis madagascariensis* Lam.

While collecting in Nixon's Harbour, South Bimini, Bahamas, in the spring of 1941, I was able to make some observations which are an interesting supplement to Mr. Lyman's discovery. While tramping across the partly exposed flats, I came across an eight-inch *Cassis tuberosa* L. which was in the process of feeding upon a heart urchin (*Clypeaster rosaceus* L.). The *Cassis*, having turned the urchin over on its aboral surface, had removed all the spines from the test in the vicinity of the anal opening. It had applied its proboscis to the opening and was extracting the animal matter.

At Nixon's Harbour, the *Clypeaster* was the predominant species in the echinoderm fauna and it is likely that it formed the major food supply of the *Cassis*.—Richard W. Foster.

Oxychilus alliarium (Miller) in Hawaii.—This rather widely introduced palearctic species of Zonitidae has appeared now at the following localities in the Hawaiian Islands:

East Maui: Puu Luau, Haleakala, altitude 6000 ft.; E. C. Zimmerman! (1945). About 3 miles from the nearest house.

Hawaii: Kilauea, about 2.5 miles from Volcano House, near summer cottages, altitude 4000 ft.; D. Walker! (1945 and 1946). Ahualea (Honokoa District, east of Waimea), altitude 2600 ft., in an open paddock, with no near habitations; Y. Kondo! (1946). Puulaalaau, south slope of Mt. Hualalai, altitude 6350 ft., about 50 yards from an orchard of apples and plums; Y. Kondo! (1946).

The three localities on the island of Hawaii are all between 2600 and 6350 ft. elevation, and are widely spaced. The second and third findings are between 40 and 50 miles from the first, and between 35 and 40 miles from each other. This would seem to indicate that *O. alliarium* has been a resident of the Hawaiian Islands for quite some time, and has been widely dispersed without coming to the attention of any collector, except during the last year or so.—C. Montague Cooke, Jr. and H. Burrington Baker.

PUBLICATION RECEIVED

The Genera Purpura and Thais in the western Atlantic. By William J. Clench. Johnsonia 2(23): 61–92, text-figs. 32–40; 1947. This beautifully illustrated and carefully collated study splits the traditional *Purpura* auct. into *Purpura* "Bruguiére," which includes *P. patula*, and *Thais* Röding, which contains the other western Atlantic species. A new subgenus *Thaisella* is proposed with *Thais trinitatensis* (Guppy) as type. The adoption of *Purpura* as a "nomen conservandum" with *P. persica* (L.) as type would be very desirable. But until such action be taken, according to opinion 46, *P. tubifer* Brug., 1792, apparently is the legal type of *Purpura* Brug., 1789, unless the brief original description effectually excludes it.—H. B. B.

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A NEW PLEURODONTE FROM THE MIOCENE, BOWDEN, JAMAICA

By DAY KIMBALL

On February 1st, 1947, Mr. C. Bernard Lewis, Curator of the Science Museum of the Institute of Jamaica, while collecting from the Miocene fossiliferous beds at Bowden, discovered an adult *Pleurodonte* in an excellent state of preservation. The unconsolidated "matrix" came away without difficulty, yielding the only perfect, adult specimen of this genus yet recovered from this well known and much worked deposit. It is quite unlike the single fragment of a lip described by Simpson in 1895,[1] and named by him *P. bowdeniana*. Through the kindness of Mr. Lewis I am able to give the following brief account of this new, and exceptionally interesting, species.

PLEURODONTE (DENTELLARIA) BERNARDI, new species. Pl. 2, fig. 10.

Shell imperforate, solid, opaque, depressed, conoid, carinate. The height below the carina is $\frac{9}{10}$ of that above it. No sculpture is now visible on the first 2½ whorls. The last 3 whorls bear irregular, markedly retrocurrent, growth lines ("incrementals"), which, as soon as they become clearly visible, can be seen to be broken up into elongated "granules." Cf. *P. carmelita* (Fér.); also the first post-embryonic whorl of *P. atavus* (Shutt.). Each granule is from 2 to 8 times as long as it is broad; and by the end of the penultimate whorl each growth line is broken into from 12 to 14 such granules between the upper and lower suture; the granules tending to become shorter in the vicinity of the lower suture. The spire is very low-conoid; the apex very obtuse; the suture, where unabraded, linear. Whorls 5½, flat. The last whorl, at its origin, is very slightly convex both above and below a well marked but only medium-sharp carina; gradu-

[1] Proc. U. S. Nat. Mus. (1895), 17, p. 450.

ally becoming more convex, and the carina more obtuse and ill defined throughout its length. It is definitely less acute than in *P. schroeteriana* (Fér.) and very similar to that of the more acute forms of *P. tridentina* (Fér.). The last whorl itself is *not* deflected anteriorly; though the upper lip is, at its junction with the elevated margin of the parietal callus. (See *infra.*)

The aperture is subhorizontal and transversely subtriangular (cf. *P. acuta* (Lmk.)). Measured in the plane of the aperture, its maximum height is 11 mm., its maximum width 15 mm. The peristome is expanded laterally and below; the basal lip being reflected and thickened and adnate over the umbilical area. The upper lip, however, is neither expanded nor reflected (cf. *P. acuta* (Lmk.)). Instead, it is deflected 1½ mm. at its insertion. The raised margin of an exceptionally heavy parietal callus becomes progressively more elevated as it approaches the upper termination of the peristome. At the junction it protrudes 1½ mm. from the parietal wall, meeting the deflected upper lip at an angle of about 110°. The margin of the upper lip has suffered some abrasion, but it seems highly improbable that it ever differed much from its present form. The peristome, therefore, appears at first glance to be free and continuous but is in fact broken for a short distance in the columella region (cf. extreme forms of *P. sinuosa* (Fér.)).

The basal lip bears four lamellar teeth, which are noticeably less deep-set than those of fully mature, living species of the *P. sinuata* group. Tooth 1 (the innermost) is extremely small and weakly developed; and is appreciably nearer to tooth 2 than to the columella (cf. those specimens of *P. tridentina* (Fér.) which have a minute 4th tooth). Interspace II–III is about twice as wide as interspace I–II. Teeth 3 and 4 are joined together for over ⅔ of their height and 3 is slightly taller and considerably longer, from back to front, than 4 (cf. *P. okeniana* (Pfr.)). Tooth 2 is more than ⅔ the height of 3, and all the teeth are heavier and taller than in *P. tridentina.*

Concealed beneath the reflected basal lip are two very short, deep pits; the inner corresponding to tooth 2; the outer to teeth 3 and 4. The inner pit is barely visible. The outer pit is much broader than the inner and appears to open into a narrow, oblique cavity which is in fact the hollow interior of tooth 3 (cf. *P. bowdeniana* Simpson). The opening is not however, I feel certain, a natural one; but has resulted from the accidental piercing of a thin calcareous wall which originally separated the external pit from the cavity. There is *no* supra-peripheral furrow.

Diameter max.: 33½ mm.; Diameter min.: 28 mm.; Height: 16 mm.

Type: 1947/1 Inst. Jam. Coll. Locality: Bowden, Jamaica, B. W. I. Horizon: 8 ft. up in basal Bowden bed.

Pleurodonte sloaneana (Shuttleworth) is related, but it is less keeled, the upper arc of the lip is more reflected, and the aperture is less triangular.

Of living forms a 4-toothed *P. tridentina* comes, perhaps, nearest to the present species; but the fossil is sharply distinguished by its sculpture; by the relative size of teeth 3 and 4; and by its semi-continuous peristome, hollow third tooth, and unreflected upper lip. Of these characters the first and the last two are of special interest. The last two are links with the Miocene representative of the *P. acuta* group, *P. bowdeniana* Simpson; and *P. bernardi* is therefore, to that extent, "transitional" between that group and the now markedly divergent and diversified group of *P. sinuata* to which the new species is allied by all its other characters. Its sculpture, on the other hand, presumably reveals the mode of origin of the densely but finely granulated surface that is today characteristic of the more evolved forms in *both* groups.

But despite these interesting "transitional" features, the new species belongs to the group of *P. sinuata* just as clearly as *P. bowdeniana* belongs to that of *P. acuta*. We can assign our two Miocene species to their respective groups without hesitation. This, in its way, is a fact of no less significance than the possession of "transitional" characters. For the groups in question are taxonomic units of an extremely low order: perhaps of about sub-sectional rank. Thus the newly discovered species proves to what lengths differentiation had already progressed some twenty million years ago. In so doing it gives us a hint of how far back in time we presumably must go before we could hope to find the prototype of the entire genus. It certainly suggests that the last exchange of *Pleurodonte* between Jamaica and any other area occurred prior to (and probably long prior to) Miocene times.

POLYGYRA VIRGINIANA, A NEW SPECIES FROM VIRGINIA

By PAUL R. BURCH

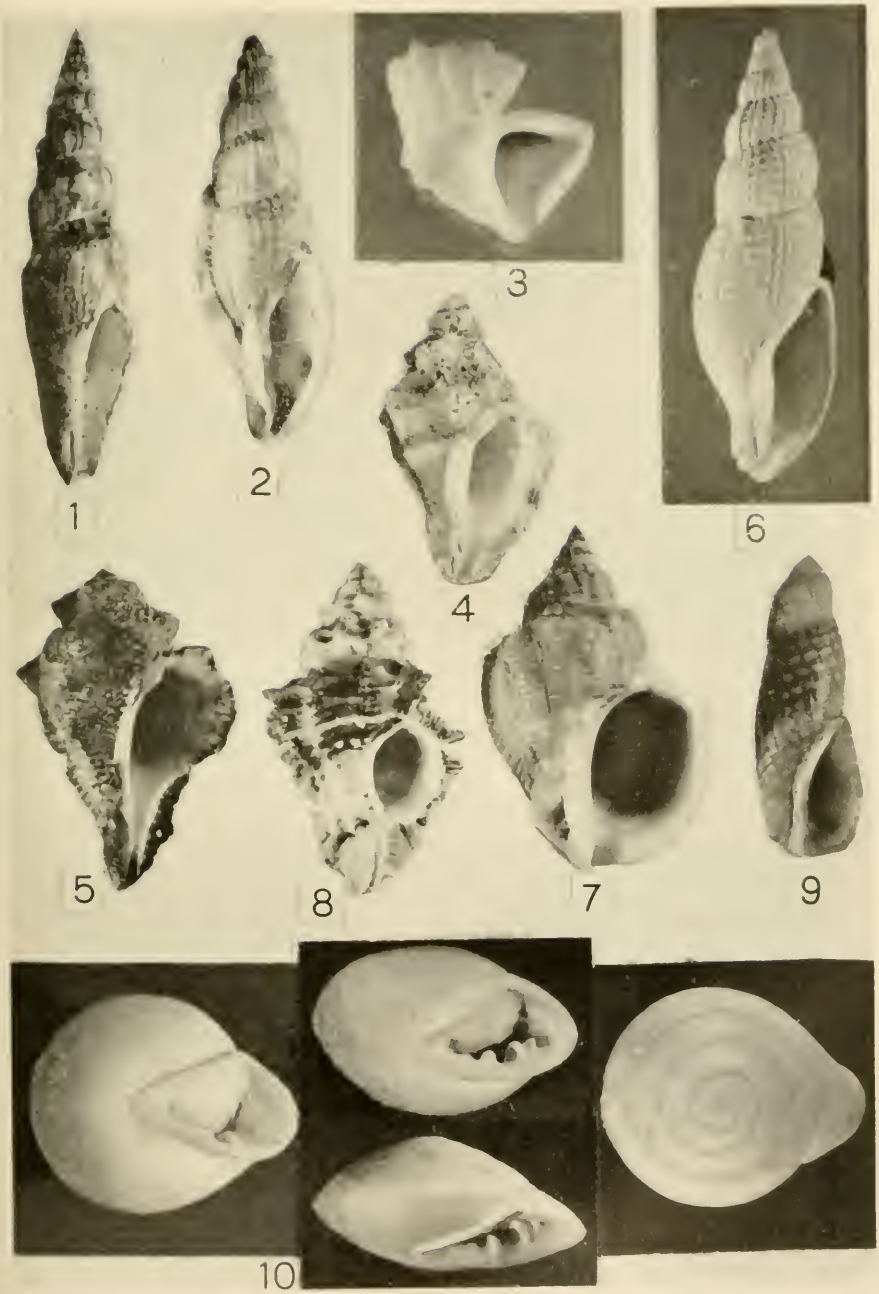
Professor of Biology, Radford College, Virginia Polytechnic Institute, Radford, Va.

While examining sifted soil from weathered Elbrook limestone (Cambrian) in a cut on a country road in Pulaski County, Virginia, opposite the city of Radford (Montgomery County), I was amazed to find a small shell resembling *Polygyra cereolus* (Muhlfeld) whose distribution in the United States is limited to Florida (Pilsbry, 1939). Further search yielded twelve other similar shells. No live specimens were found. The collecting station was approximately sixty feet above New River at an elevation of 1800 feet and two feet below the topsoil containing living plants. Along with it and in the topsoil were the weathered shells and living individuals of thirty or more Recent species of such genera as *Retinella, Paravitrea, Haplotrema, Gastrocopta, Ventridens, Mesomphix, Anguispira, Helicodiscus, Mesodon, Triodopsis* and *Pomatiopsis.*

Comparison with *P. cereolus* showed the new shell to be much smaller and to have fewer whorls. Instead of a lamina on the parietal wall there is a fold on the outer wall. The last whorl is swollen on the latero-ventral side like *P. c. carpenteriana* (Bld.). Unlike *P. cereolus* it shows raised spiral lines on all the whorls and a callus in the base. As the only species of the genus *Polygyra* to be reported from the state of Virginia, I propose to name it *Polygyra virginiana.* The Type (Holotype) has been sent to the U. S. National Museum and Paratypes to the Academy of Natural Sciences of Philadelphia.

Polygyra virginiana new species. Pl. 3, figs. 1–6.

Shell discoidal, umbilicus very shallow, spire not prominent, dorsal and ventral surfaces almost parallel; whorls slightly more than four, regularly increasing in size, a swelling on the last third of the ventro-lateral surface of the body whorl, a deep groove opposite it on the dorsal surface extending backward 1.4 mm., the end of the last whorl breaking away from the preceding whorl at an angle of about 60° and extending outward about 1.0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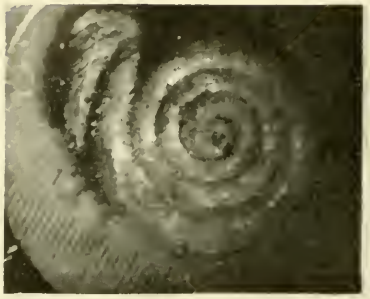


Fig. 1

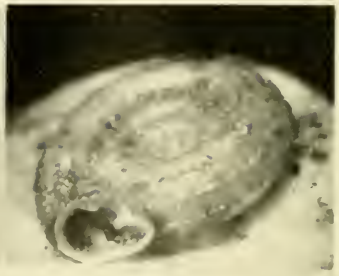


Fig. 4

Fig. 2

Fig. 5

Fig. 3

Fig. 6

mm.; rib striate with four prominent spiral lines 0.3 to 0.35 mm. apart becoming more prominent toward the aperture with less prominent lines between them, all spiral lines more or less papillate; whorls rounded, lip white and slightly reflected; aperture heart-shaped, 1.3 × 1.0 mm. with V-shaped parietal tooth; a white fold 1.4 mm. long and 0.2 mm. high extends inward along the outer wall, beginning about 0.3 mm. from the aperture; a transverse callus on the parietal wall 0.4 mm. long and 0.1 mm. high fits into the arch formed by the fold; color of shell wood brown. Measurements of twelve specimens as follows:

Specimen	Diameter	Height	Whorls	
1	4.3 mm.	1.3 mm.	4.5	
2	3.9	1.3	4.2	
3	4.0	1.3	4.0	
4	4.4	1.3	4.5	
5	4.3	1.4	4.5	
6	4.2	1.4	4.6	Type (Holotype)
7	4.0	1.3	4.3	
8	4.0	1.3	4.6	
9	4.1	1.3	4.1	
10	4.1	1.3	4.5	
11	4.0	1.3	4.1	
12	4.1	1.4	4.5	

Key to Figures, Plate 3. Magnification × 9.5 except fig. 6

Fig. 1. Dorsal view showing whorls, projecting end of body whorl, groove and growth lines
Fig. 2. Dorso-lateral view showing spacing of spiral lines
Fig. 3. Side view showing ventro-lateral swelling
Fig. 4. Ventro-lateral view showing spiral striations, aperture with tooth, fold and callus and umbilicus
Fig. 5. Ventro-lateral view showing whorls, umbilicus, aperture, tooth, fold, callus, swelling and striations of a weathered specimen without epidermal covering
Fig. 6. View of dissected shell showing arched fold with callus fitting into it. × 10 (approximately)

Note: The photomicrographs were made with a Spencer wide-field binocular microscope using an × 1 Objective and an × 17 Ocular; exposures were made with an A–2–F Argus camera at f 4.5, ½ second, on 35 mm. Plus X Eastman film; negatives were enlarged 2 × to make the prints.

COWRY HUNTING ON CEBU ISLAND

By JACQUES R. HELFER

The little coastal village of Liloan, some fifteen miles out of Cebu City, Cebu Island, in the central Philippines, is a picturesque settlement of about two hundred houses, huddled under feathery coconut palms. Overhead a fierce tropical sun beats mercilessly down, but here below, in the umbrage, the temperature is tolerable. The main street is a noisy unpaved thoroughfare where chickens run and children dash about, where the dusky townspeople converge daily to do their marketing and to meet their friends, and where light elusive sea-breezes play. The houses along both sides are built up off of the ground on heavy poles so, one learns, that stray water buffalos will not wander inside. A mélange of heavy odors fills one's nostrils along this distant way, odors of fish and sea-cucumbers and calipash, of ripe fruits in the baskets of the vendors, of the potent orange-hued *tuba* and a hundred other odors. Chaste white-flowered Butterfly Orchids bloom exotically from the porches of the poor little houses. Nearby stands the huge old church, with its great flat unbroken façade, curved at the top and with only a raised coat-of-arms for decoration, built of coral blocks sawed from the nearby reefs by slave labor of the Filipinos under the Spanish. A modern concrete school lays in ruins, gutted by fire, its metal roof hanging in rusted shreds over all, burned by the Japanese.

At one end of the street the men are gathered intently around a circular flat stone, squatting on their haunches and risking their small day's earnings on the turn of a coin. "Kings," their popular gambling form, daily takes the bread from many a hungry mouth. Now and again a dispute arises and there is much shouting and angry invective. Nearby a crowd surrounds a slight effeminate Filipino who is seated behind a little table running a game of "chance" similar to our Bingo, singing in Visayan calypso rhyme as he shakes his slender-necked jar this way and that and then dramatically turns out the next round numbered seed. Another Filipino chords endlessly in accompaniment on a battered guitar. Now and again the *Baiyute*

daintily dabs at his glistening forehead with an embroidered handkerchief. Now the mountebank-singer's verse is directed at one of the players and everyone laughs at his expense. Rising to the occasion the player sings a pointed verse in retaliation and it is plain from the action of the artist, who enjoys it nevertheless, that the player's verse has found its mark.

The other end of this main thoroughfare abuts on the waterfront where several of the better homes are located, overlooking the river. This river is the harbor for many fish boats. As the tide ebbs the water flows down this channel in a powerful current and it rushes through the narrows under the bridge with tremendous force. When the tide changes, the water flows back, in a great sweep, backing far up into the broad slough which lies beyond, bordered with teakwood trees and banana, with coconut and Hibiscus. It is good sport to swim up into the slough with the inrushing waters, exploring the wrecked Japanese barges there, lying in the sun on their bleaching decks, then swimming back when the tide changes. Swimming under water along the edge of this channel, where the current is not so swift, one often encounters the great Tiger Cowry, *Cypraea tigris* Linnaeus, making its way slowly over the rocks. Farther out, at the mouth of the river, there is a broad fringing reef extending uninterruptedly along the coast for miles in both directions. This reef is the home of many species of cowries. The Ring and Money cowries, *C. annulus* Linnaeus and *C. moneta* Linnaeus, here abound as does also the little serpent starfish. Farther out *C. gangranosa* Dillwyn and *C. staphylaea* Linnaeus, *C. erosa* Linnaeus and *C. clandestina* Linnaeus may be taken in water knee to waist deep from coral boulders which one dredges up with the hands. Here the nektonic pulsating jellyfish, translucent and bluish, propels itself along through the warm swell and bright varicolored urchins abound in the algal growths, their spines presenting a real hazard to the barefoot collector. And here too one may encounter another jellyfish whose presence will be first revealed by a sudden burning lash like a handful of nettles whipped across the legs. A certain sergeant, Rene "Duke" Ducharme by name, had a rather amusing experience on this reef one day. He wanted some ring cowries in order to make some novelties for his wife, so I had invited him to accom-

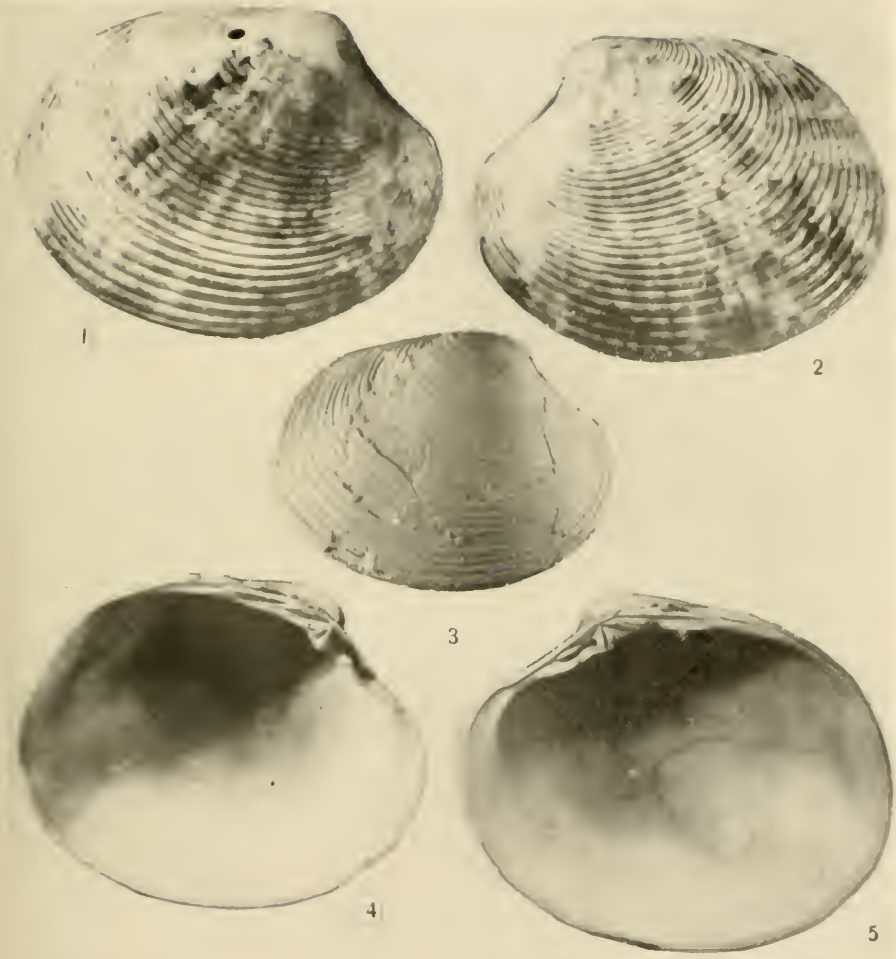
pany me on a collecting excursion. We were wearing swimming trunks, he a tight fitting woolen pair. Soon we were tearing up handfuls of the aquatic growth and picking the cowries out of their hiding places in among the stems. Having brought no bag along and being reluctant to combine our catches, "Duke" began dropping the cowries down into his trunks which, being close-fitting, were not bad at all in their secondary role of collecting bag. All went well until he found a specimen of the Diana's Ear shell, *Strombus auris-dianae* Linnaeus, which he also dropped into his makeshift collecting bag. Now the animal of this particular shell is very unusual. It has an intelligent looking little face with which it peers quickly at one from around back of its columellar rampart. It moves very rapidly—not "snail-like" at all. And it has a long dagger-like operculum with which it ordinarily hurls itself along over the substratum much like a pole-vaulter but with which it earnestly tries to stab one if one presumes to hold it in the hand. Well, about half a minute passed when there came a sudden outraged yell from the "Duke" as the little delinquent living in the shell viciously scored on him up to the hilt. Touché! I have no doubt that the sergeant established some sort of speed record in getting out of those trunks. In addition, before the afternoon was over, he walked on an urchin!· Specimens of *C. carneola* Linnaeus, *C. lynx* Linnaeus, and *C. vitellus* Linnaeus were not uncommon on this reef, the first often occurring in among the branches of the thick mat-like marine growth in company with *C. annulus* and *C. moneta*. *C. lynx* and *C. vitellus* were usually under coral boulders on the reef. *C. talpa* Linnaeus, *C. mappa* Linnaeus, *C. eglantina* Duclos, *C. errones* Linnaeus, and *C. asellus* Linnaeus also occur on this reef but are very uncommon there.

NOTES ON COSTACALLISTA EUCYMATA (DALL)

By KATHERINE VAN WINKLE PALMER

Paleontological Research Institution

In the course of examining specimens of "*Pitar eucymata*" (Dall) from Key Largo, Florida (66 fathoms), for Richard W.



1, 2, 4, 5. Costacallista eucymata (Dall), off Fowey Light, Florida.

3. Costacallista olssoni Palmer, holotype, Miocene, Costa Rica.

Foster, Museum of Comparative Zoölogy, Harvard University, relationships of the species became apparent which had not been observed heretofore. The original figure of the species does not give a true concept of the shape of the shell. It, therefore, seemed worth while to illustrate the species and point out a revised idea of its relationship and the range of the genus.

COSTACALLISTA EUCYMATA (Dall) Pl. 4, figs. 1, 2, 4, 5

Cytherea sp., Dall, 1889, U. S. Nat. Mus., Bull. No. 37, p. 56.
Cytherea eucymata Dall, 1889, U. S. Nat. Mus., Proc., vol. 12, p. 271, pl. 13, fig. 11.
Pitaria eucymata Dall, 1902, U. S. Nat. Mus., Proc., vol. 26, p. 371; Palmer, 1927 (plates 1929), Palaeont. Amer., vol. I, No. 5, p. 51, pl. IX, fig. 7, copy of original description and figure.

Cape Hatteras, North Carolina, south through the Antilles, and Cape San Roque, Brazil; Mississippi Delta and Cedar Keys (Dall) in 20 to 117 fathoms. Figured specimen, No. 457195, U. S. Nat. Mus. in 25 fathoms off Fowey Light, Florida, collected by John B. Henderson. The following records of fresh material of the species were sent by R. W. Foster from the collections in the Museum of Comparative Zoölogy:

Sta. 4, 5, 4–5½ mi. NE. of the Elbow, Key Largo, 50–83 fms.; Sta. 12, 13, 4–6 mi. SE. of the Elbow, Key Largo, 66–75 fms.; 108–117 fms.; Sta. 8, 4–5 mi. SE. of Carysfort Light, Key Largo, 92–100 fms.; Sta. 21, 5 mi. NE. of Carysfort Light, Key Largo, 117 fms.; Sta. 28, 3½ mi. SE. of Molasses Reef, Key Largo, 66 fms.; Sta. 34, 6 mi. SE. of Sombrero Light, off Key Vaca, 66 fms.; Sta. 38, 2½ mi. SSE. of Looe Key, off Sugar Loaf Key, 37½ fms.

The specimen figured measures 24 mm. length; 19 mm. height; 12 mm. thickness (both valves). Harvard shell measures 27 mm. length, with fragments indicating that a length of 35–40 mm. may be attained (*fide* Foster).

Dall placed this species in *Pitar* (*Pitaria*) in 1902, where it has been retained by subsequent authors including the writer in 1927, in the monograph of the Veneridae of the eastern American fauna. Recently, specimens of the species were loaned to the author by Dr. Harald Rehder from material in the U. S.

National Museum. These specimens were compared with the holotype (a single valve) and identified as typical. The original figure represents the shape of the shell with a steeply sloping short anterior end and a curved dorsal posterior line. The shape, however, as revealed by the specimens examined and figured herein, is more produced anteriorly with a greater concavity beneath the beaks. The posterior end is broader, with the dorsal line straight. To the original description may be added that the lunule is inequilateral; the narrow anterior left cardinal, partly bifid (not shown in the picture); and the interior below the umbo, pinkish or pinkish orange.

Dall had not noted the significance between costate Pitars and "Callistas" and placed the east American species, such as *C. planivieta* Guppy (Miocene), and *C. eucymata* (Dall) (Recent), in *Pitar* (*Pitaria*). Guppy, Gabb, and Pilsbry observed the callistoid character of *planivieta*. The author in 1927 differentiated the costate "Callistas" as *Costacallista* including described species of the Eocene of the east American fauna, *C. planivieta* (Miocene, Florida, and West Indies), *C. olssoni* Palmer (Miocene, Costa Rica) and *C. guppyana* (Gabb) (Pliocene, Costa Rica). Since that time a species of *Costacallista* has been described from the Miocene of North Carolina. Due partly to lack of material in 1927, the writer kept *C. eucymata* in *Pitar*. However, on the recent examination of the Harvard and U. S. National Museum material the callistoid rather than pitaroid character of this species was seen.

The chief features which indicate the callistoid relationship are the flatter ribs, the inequilateral lunule, and the more angulated pallial sinus. There is also a general resemblance to the Costacallistas rather than to Lamelliconchas (ribbed Pitars). *C. eucymata* is the only species of *Costacallista* so far described from the western Atlantic. It is closest in appearance to *C. olssoni* Palmer (1927, p. 90, pl. XLIV, fig. 5) of the Miocene of Costa Rica. A figure of the holotype of *C. olssoni* is included (fig. 3). The shells of the two species differ in that the concentric ribs of *C. eucymata* are more curved posteriorly than those of *C. olssoni*. The figured specimen of *C. olssoni* is 32 mm. in length.

If the table of the stratigraphic range of *Costacallista* is ex-

amined (Palmer, 1927, p. 85), it will be seen that the group was best developed in the Eocene of the western Atlantic province and less abundant but still well represented in the Miocene. *C. emmonsi* Gardner (U.S.G.S., Prof. Paper, 199A, 1943, p. 123, pl. 19, figs. 6, 9) should be added to the stratigraphic range. One species in the Pliocene is recorded, and up to the present it was thought that no species existed in the living fauna of eastern America. Reclassifying *C. eucymata* would transfer the name from the stratigraphic range table (Palmer, p. 40) of *Lamelliconcha* to *Costacallista*. Hence such change reveals that there is a species representative of *Costacallista* in the living eastern American fauna. The genus is best developed today in the Indo-Pacific and in the Red Sea. *C. eucymata* is probably a remnant of the Cenozoic stock of *Costacallista* in the eastern American fauna.

Because of the nomenclatural problem in which the name *Callista* is involved, *Costacallista* is used here in the generic sense. The author does not agree with Frizzell (Bull. Mus. roy. d'Hist. nat. Belg., t. XII, 1936, p. 31) that *Costacallista* and *Amiantis* Carpenter are synonymous. The rugose posterior left cardinal and edge of the right nymph and the acute pallial sinus of *Amiantis* particularly separate it from *Costacallista*.

Thanks are extended to Richard W. Foster of the Museum of Comparative Zoölogy, Harvard University, to Dr. Harald Rehder, U. S. National Museum, and to G. D. Harris, Paleontological Research Institution, for permission to study specimens of *Costacallista*, and to Dr. W. Storrs Cole, Geology Department, Cornell University, for permission to examine venerid specimens in the Newcomb Collection.

ADDITIONS TO THE MOLLUSCA OF LAKE WORTH, FLORIDA

By A. HYATT VERRILL

During the past two years I have collected the following mollusca in Lake Worth, none of which, I believe, has been previously recorded from this area.

Asaphis deflorata: A single living specimen was collected on June 12th, 1945.

Rangia cuneata: A good sized colony of this shell was found and a number of living specimens were collected during June and July 1945. It has since been taken occasionally at the same spot but recent dredging operations have apparently destroyed this, as well as many other species.

Barnea costata: Numerous dead shells and two living specimens collected.

Cymatium femorale: A single dead specimen found in the summer of 1946.

Charonia tritonis nobilis: A living specimen 5 inches in length was collected in August, 1945.

Strombus samba: Two living and one recently dead (with portion of animal remaining in shell) specimens.

Strombus pugilis alatus: A number of typical specimens of this west coast form have been collected, all from one small colony.

Melongena melongena: Two living specimens, 57 mm. and 74 mm., collected at Lantana during the summer of 1946.

Marginella carnea: Several living specimens taken under the Riviera bridge.

Mytilus edulis: Several living specimens collected in brackish water lagoons connecting with Lake Worth. They were found adhering to mangrove roots just above low water mark.

Aplysia: Twenty-seven species, most of which are undescribed, have been collected and turned over to the American Museum of Natural History, New York City.

Oscanius: A single large, brilliantly colored specimen of this remarkable mollusk was collected in May 1945. Dr. Paul Bartsch, to whom the specimen was submitted, wrote: "It seems to be *Oscanius testudinarius* Contraine, hitherto reported only from the Mediterranean, but it is most likely a new species."

FOOD OF THE GIANT WESTERN SLUG, ARIOLIMAX COLUMBIANUS (GOULD)

By WILLIAM MARCUS INGRAM AND ANN PETERSON

Mills College, California

Although individuals of *Ariolimax columbianus* (Gould) are abundant in certain areas of the Mills College Campus they have only occasionally been observed feeding on plants in the field. This slug is especially abundant in relatively moist areas in the vicinity of a small creek, Leona Creek, which flows through the campus. It has made no attempt to establish itself in the several gardens and in the many plant beds on the campus. Although arboreal tendencies have been noted (Ingram and Adolph, 1943), individuals generally confine their activities locally to the ground. Because of this, only low growing plants which might serve as a natural food were tested to see if they would be eaten. Twenty-five species of plants were made available to *A. columbianus* from March 1 to May 16, 1947.

Pairs of slugs were placed in five terraria with moist, well-packed earth substrata and with screen tops to allow for air circulation. The terraria were kept at room temperature. The plants to be tested as a potential food supply were added from time to time. Of the twenty-five species tested nine were relished (as lettuce is), six were partially consumed, five were nibbled at, and five were not touched.

Among the apparently most favored food plants, the Smooth Dandelion, *Taraxacum laevigatum* (Willd.) DC., was the most rapidly devoured, although the snails had been fed the day before this plant was added to the terraria. Flowers, leaves, and stems were rapidly rasped away. The leaves of Poison Oak, *Toxicodendron diversilobum* Torr. and Gray, were likewise rapidly devoured; even the bark from the woody stems was nibbled at. Ingram (1942) observed *Ariolimax columbianus* (Gould) feeding on the leaves of this plant under wild conditions.

In three instances plant flowers were preferred over leaves. The slugs relished the flowers of the California Poppy, *Eschscholtzia californica* Cham., and the common Periwinkle, *Vinca minor* L., but ate sparingly (partially consumed) of their leaves.

The flowers of the California Buttercup, *Ranunculus californicus* Benth., were partially consumed while the leaves and stems were merely nibbled at.

When English Ivy, *Hedera helix* L., was added to the terraria it was observed that the slugs relished the vegetative leaves but would not eat the reproductive leaves.

Gramineae were generally not eaten; one tested species, Mouse Barley, *Hordeum murinum* L., however, was nibbled at.

Plants made available to *Ariolimax columbianus* for feeding experiments

Aizoceae. Carpet-weed family: *Mesembryanthemum crystallinum* L., Iceplant Mesembryanthemum (D).[1]

Amaranthaceae. Amaranth family: *Deeringia amaranthoides* Merr., Deeringia (A).

Anacardiaceae. Sumac family: *Toxicodendron diversilobum* Torr. and Gray, Pacific Poison Oak (A).

Apocynaceae. Dogbane family. *Vinca minor* L., Common Periwinkle, Flowers (A), Leaves (B).

Araliaceae. Aralia or Ginseng family: *Hedera helix* L., English Ivy, Vegetative leaves (A), Reproductive leaves (D).

Caryophyllaceae. Pink family: *Stellaria media* L., Chickweed (B).

Compositae. Sunflower or Composite family: *Taraxacum laevigatum* (Willd.) DC., Smooth Dandelion (A).

Cruciferae. Mustard family: *Brassica campestris* L., Common Yellow Mustard (B). *Raphanus sativus* L., Garden Radish (C).

Geraniaceae. Geranium family: *Geranium* sp. (A).

Gramineae. Grass family: *Avena fatua* L., Wild Oats (D). *Bromus rigidus* Roth, Ripgut Bromus (D). *Hordeum murinum* L., Mouse Barley (C). *Lolium* sp., Italian Ryegrass (D). *Poa annua* L., Annual Bluegrass (D).

Iridaceae. Iris family: *Sisyrinchium bellum* Wats., Western Blue-eyed Grass (B).

[1] In the plant list, A stands for relished; B for partially consumed; C for nibbled at; D for not touched.

LABIATAE. Mint family: *Stachys bullata* Benth., Puffnettle Betony (C).

LEGUMINOSAE. Pea family: *Cytisus scoparius* Link, Scotch Broom (C). *Vicia sativa* L., Common Vetch (C).

LILIACEAE. Lily family: *Brodiaea coronaria* (Salisb.) Jepson, Harvest Brodiaea (B).

PAPAVERACEAE. Poppy family: *Eschscholtzia californica* Cham., California Poppy, Flowers (A), Leaves (B).

PLANTAGINACEAE. Plantago family: *Plantago lanceolata* L., Buckhorn Plantain (B).

PORTULACEAE. Purslane family: *Claytonia perfoliata* Donn., Miners Lettuce (A).

RANUNCULACEAE. Crowfoot family: *Ranunculus californicus* Benth., California Buttercup, Flowers (B), Leaves and stems (C).

RUBIACEAE. Madder family: *Coprosma baueri* Endl., Hedge Coprosma (A).

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ANODONTA AND ASSOCIATED MOLLUSKS FROM STOW LAKE, GOLDEN GATE PARK, SAN FRANCISCO, CALIFORNIA

BY WILLIAM MARCUS INGRAM AND KARL W. KENYON

Mills College, California

Stow Lake in Golden Gate Park, San Francisco, California, is an artificial lake. It has a mud bottom which is extremely rich in organic decay. The shore is rimmed with a cemented rock border.

In February and March of 1947 this lake was partially drained, thus exposing its molluscan fauna. By far the most prevalent species is *Anodonta wahlamatensis* Lea which occurs by the thousands in the mud bottom. Other mollusks taken from the bot-

tom mud were: *Viviparus japonicus* Von Martens, *Lymnaea auricularia* Linnaeus, *Helisoma cf, hemphilli* F. C. Baker, *Gyralus vermicularis* (Gould), *Physa* [(?) *virgata* (Gould)], and *Pisidium* sp.

Specimens of *Anodonta wahlamatensis* Lea were taken from two feet from the shore line to fifteen feet out in the lake. When filled with water the lake would have covered the mollusks with from about one to four or five feet of water. In a period of an hour 238 clams were collected. Specimens varied from very young claims, seven mm. in length, to the largest individual which had an anterior-posterior measurement of 89 mm. The vast majority of the 238 clams which were measured fell between 59 to 89 mm. in length, with the high number at 67 mm. This latter figure very likely represents the approximate mean of the adult population of this clam in Stow Lake.

The largest measured individual clam from Stow Lake is relatively small when compared to certain individuals of this species from elsewhere in California, which often attain a length of from 93 to 110 mm. The most characteristic feature of the Stow Lake population is the relatively low height of the wing in relation to shell length; shells of this species found in middle California have a much higher wing.

Specimens taken from drainage puddles in the mud rested at an angle of approximately 45 degrees to the substratum with the siphonal end of the shell protruding. Seven individuals were placed in an aquarium with a very coarse sand bottom in the zoological laboratories of Mills College. The sand was not deep enough to allow for complete burial by the clams. Three of the seven individuals remained on the surface of the sand in a horizontal position resting on their ventral surfaces. Four buried themselves to a maximum extent allowed by the shallow sand. In their buried position they rested at an angle of about 45 degrees to the substratum. In both of the above positions the siphon areas were at all times held open. At this writing the clams have been in an unaerated tank for about 70 days. When sand was added to increase its depth in the aquarium all clams buried themselves, leaving approximately one-fourth of their shells exposed with the siphons open. The clams proved to be errant, often moving from 6 to 10 inches over the bottom of the

aquarium in a 24 hour period. Polywogs of the Pacific Tree Frog, *Hyla regilla* Baird and Girard, which were co-inhabitants of the aquarium, were observed filing algae off of the clam shells.

It seems to the writers that *Anodonta wahlamatensis* Lea can be separated from the apparently closely related species, *Anodonta nuttalliana* Lea (two species that are often confused), by two fairly well defined characteristics. *A. wahlamatensis* Lea possesses an excavated, concave area posteriorly in the wing where it unites with the body of the shell. It also has the sides of the shell more noticeably convex-inflated. Further collecting of large series of individuals may show intergradations of these two characters from *A. wahlamatensis* to *A. nuttalliana*. The Stow Lake population, however, in the writers' opinion, has the two characters which can be used for separation well fixed. A similarity of other shell characters, with the exception of these two, can of course lead to a subspecific separation of the two into *Anodonta nuttalliana nuttalliana* Lea and *Anodonta nuttalliana wahlamatensis* Lea.

The writers wish to express their appreciation to Mr. Bart Rolph, Assistant Superintendent, Office of the Park Commissioners, San Francisco, California, for granting them permission to make the collections upon which this paper is based. Gratitude is expressed to Mr. Allyn Smith of Berkeley, California for reading the manuscript and for his helpful suggestions.

A RECENT PERPLICARIA AND OTHER NEW PANAMIC MARINE SHELLS

By MAXWELL SMITH

CRASSISPIRA PERLA, new species. Plate 2, Figure 2.

Shell large, slender, whorls 8 in addition to the nucleus (broken in holotype); sutures moderately impressed, their course undulating; spiral ribs or riblets strongest anteriorly upon the body whorl, growth sculpture consisting of closely spaced irregular ribs together with striae and blunt nodules (ten of the latter upon body whorl); posterior notch distinct, previous indentations strong between sutures and periphery; aperture narrow, gradually tapering into anterior canal which is slightly reflected at the termination. Alt. 60, max. diam. 14.5 mm.

Type locality: Pearl Islands, Panama (Clark). Holotype in the writer's collection.

Possibly the most slender Crassispira so far discovered. The holotype was not taken alive but in sufficiently good condition to describe. It does not appear to be related closely to any other species.

VITULARIA SALEBROSA EXTENSA, new subspecies. Plate 2, Figure 5

This constant type is easily separated according to its discoverer Mr. Clark. In the subspecies the spire is decidedly shorter and the peripheral angle much greater and more extended than in the typical *salebrosa*. Alt. 41, max. diam. 27.5 mm.

Type locality: Panama. Holotype in the writer's collection.

V. salebrosa is very variable in size. An example from the Calvert collection, probably from the coast of Colombia, is 87 mm. in length.

TRIGONOSTOMA ELEGANTULA, new species. Plate 2, Figure 3

Shell small, about as wide as high; 3 whorls, with in addition a minute darker colored nucleus of about 1 whorl; surface of shell minutely spirally striate; periphery acutely carinate, surface descending within to the suture; 7 varices upon the final whorl, their terminations forming pointed processes upon the peripheral keel, the interspaces undulating; secondary keel rounded, slope between the two keels concave; umbilicus open, wide, funnel shaped; aperture trigonal; lip widely expanded, a single denticle upon parietal wall. Alt. 10.5, max. diam. 11.5 mm.

Type locality: Pearl Islands, Panama (Clark). Holotype in the writer's collection.

A beautiful little shell. The spire is flecked with chocolate-brown color. The nucleus is flesh color in contrast to the chalky surface of the shell.

MUREX VITTATUS MINUSCULUS, new subspecies. Plate 2, Figure 8

Easily separated from *vittatus* Broderip by the much smaller size, more slender shape and pinched appearance on back of last whorl. Alt. 18.5, max. diam. 11.5 mm.

Type locality: Pearl Islands, Panama (Clark). Holotype in the writer's collection.

COLUBRARIA PANAMENSIS, new species. Plate 2, Figure 6

Shell slender, of medium size for the group, whorls 6 with in addition a tilted glassy nucleus of 2½ whorls; spiral riblets dominant upon the last whorl with one to three finer riblets in the interspaces, upon the spire the growth riblets of equal strength forming a network pattern, growth riblets forming a puckered suture; aperture narrow, often less than half length of shell; anal notch variable, anterior canal widely deflected, varices of moderate width. Alt. 29, max. diam. 9 mm.

Type locality: Panama Bay (Clark). Holotype in the writer's collection.

Allied to but usually a much narrowed shell than *C. lanceolata* Menke the Atlantic species. The spire is higher in the Pacific shell and the sculpture generally coarser. A specimen of *C. lanceolata* from the Caribbean in the vicinity of the Canal Zone shows rather widely spaced axial ribs.

COLUBRARIA PERLA, new species. Plate 2, Figure 2

Shell very slender, small, whorls 5, with in addition a dark brownish glassy and slightly tilted nucleus of 2½ whorls; vertical and horizontal riblets of almost equal strength throughout, suture puckered, aperture narrow, inner wall of aperture much more bent than in *C. panamensis,* anterior canal short; surface more or less spotted with chocolate-brown color particularly upon the varices. Alt. 21.75, max. diam. 17 mm.

Type locality: Pearl Islands, Republic of Panama (Clark). Holotype in the writer's collection.

PERPLICARIA CLARKI, new species. Plate 2, Figure 9

Shell small, 3½ somewhat swollen whorls with in addition a few-whorled shining nucleus; sutures well impressed; a single broad strong varix not far back from the outer labrum, the interspaces deeply furrowed; spiral riblets most conspicuous anteriorly upon body whorl and adjacent to sutures; surface colored with brownish-yellow forming lighter zones of small squarish or diamond shaped spots which are visible upon the two final whorls; aperture well expanded anteriorly, outer labrum lined

inside with weak lirae extending inward; three plaits upon inner wall, the adjacent surface granulate; slight indication of anterior notch. Alt. 16.5, max. diam. 6.5 mm.

Type locality: Venado Island, Panama (Clark). Holotype in the writer's collection.

Dall suspected that eventually a recent species of *Perplicaria* would turn up. He described *P. perplexa*, the genotype, as from the Pliocene of Florida. The recent shell is more compact, the penultimate whorl more swollen, the sculpture less pronounced than the fossil. The plaits upon the inner wall indicate connection with the Mitridae. Named for Walter D. Clark.

THE AMERICAN MALACOLOGICAL UNION THIRTEENTH ANNUAL MEETING

PACIFIC GROVE, CALIFORNIA, JUNE 18 TO 21, 1947 [1]

The American Malacological Union held its thirteenth annual meeting at Pacific Grove, California, at the invitation of Mr. Andrew Sorensen and the Directors of the Hopkins Marine Station. Asilomar Hotel and Conference Grounds with its spacious grounds, dormitories, cottages, and conference halls, provided a convenient meeting place in a beautiful setting. The local committee had been at work long before the start of the meetings and were on hand to greet each new arrival. As a pleasant surprise, each registrant was presented with a box containing named shells from the Pacific Coast, the gift of Messrs. Sorensen and Strohbeen and Mrs. Whelchel. The afternoon of the 17th was spent renewing old acquaintances and making new ones. In the evening, members of the Union visited an exhibit of marine life prepared by Mr. Strohbeen and a collection of abalone shells from California and other parts of the world prepared by Mr. Sorensen.

The first scientific meetings were held Wednesday morning, June 18. Dr. Henry van der Schalie, President, opened the meeting and called on Dr. L. R. Blinks, Director of the Hopkins

[1] By Aurèle La Rocque, acting for the Secretary, who was unable to attend.

Marine Biological Station of Stanford University. Dr. Blinks welcomed the Union to Pacific Grove and the Laboratory and invited members to make it their home insofar as possible during their stay. Dr. van der Schalie responded to Dr. Blinks' address of welcome and lauded the excellent arrangements made by Mr. Sorensen and Dr. Blinks for the meeting.

The meeting then passed to the presentation of scientific papers. Since complete abstracts of each paper will appear in the "News Bulletin and Annual Report" of the Union, only a list of titles is appended to this report.

The Annual Dinner was held in the Dining Hall of Asilomar Wednesday evening. A special menu had been prepared for the occasion through the good offices of the local committee and was offered to the members of the Union in attendance with the compliments of Mr. Andrew Sorensen, who bore the entire financial cost of the banquet. The menu was unusual and appropriate for a meeting of malacologists. The main course was broiled abalone, preceded by shrimp cocktail and accompanied by crabmeat salad. The main speakers at the dinner were the President, Dr. Henry van der Schalie, who voiced the thanks of the guests to the local committee. Mr. John Q. Burch spoke briefly of the pleasure of the western group at having a meeting on the west coast and being able to exchange ideas and impressions with members from the east. Mr. Sorensen expressed pleasure in seeing a good representation of members from the east, and urged Pacific Coast members to do their utmost to attend the next meeting in the east. Dr. F. M. MacFarland, Mr. Emery, Messrs. Dranga, Spicer, Kimball, and Haas also spoke briefly.

After the Annual Dinner, the Council met briefly. The business considered was mainly recommendations for a meeting place in 1948 and the preparation of a slate of officers for the coming year.

Early in the morning of Thursday, June 19, some especially enthusiastic members took advantage of the exceptionally low tides then prevailing to go out collecting at 5 o'clock in the morning. The booty was pronounced worthy of the special effort and admired by later-rising members. A short business meeting preceded the scientific sessions. The President read the slate of

officers prepared by Council: for President, Dr. A. Myra Keen; for Vice-President, Dr. Elmer G. Berry; for Secretary, Mrs. Harold R. Robertson; for Treasurer, Mr. Harold R. Robertson; for Councillors, Mr. John Q. Burch, Dr. John Oughton, Dr. Joseph C. Bequaert, and Mr. Allyn G. Smith. There being no other nominations, the slate of officers was elected unanimously.

The President then announced that the Union had been invited to meet in Pittsburgh next year. The meetings will take place at the Carnegie Museum, Pittsburgh, August 25, 26, and 27, 1948. Details will be announced later. The reports of the Secretary and of the Treasurer were read and approved. The remainder of the session was devoted to the reading of scientific papers, as was the afternoon session.

In the evening, an illustrated address on marine life of the Monterey region was delivered by Dr. Ralph Bolin, Assistant Director, Hopkins Marine Station. Mr. Sorensen, introducing the speaker, promised that we would see some very special movies of marine life. Dr. Bolin's films more than fulfilled the promise. Starfish, brittle stars, sea anemones, ghost crabs, etc., as well as mollusks, were shown in the full glory of the color of the living animal; this was quite a treat to those of us who knew these invertebrates only as dried or preserved specimens. Dr. Bolin's remarks were timed to perfection for the appearance of each new subject and provided a wealth of information about each one. The talk aroused much discussion which carried on far into the night.

Friday the 20th of June began early, at 5 A.M. to be exact, with a shore collecting trip led by Mr. Ferdinand Ruth, Science Instructor at Monterey Junior College, whose intimate knowledge of the collecting grounds of the Monterey Bay area assured an abundant and choice catch even for those who had not done any marine collecting before. The trip had been arranged to take advantage of the unusually low tide. The scientific sessions opened at 10 A.M. and continued throughout the day.

On Saturday, the 21st of June, another party of insatiable collectors under the leadership of Mr. Ruth raided the rocks exposed at low tide in Monterey Bay and returned loaded down with much booty. During the morning members of the Union

were shown the famous Seventeen-Mile Drive and Point Lobos Reserve State Park where they were able to observe the two species of seals and sea lions on the rocks off the coast as well as a great number of sea birds, including cormorants and pelicans. The tour was sponsored by the Pacific Grove Chamber of Commerce who are to be congratulated on the efficiency of their arrangements.

In the afternoon a large party of members visited the Hopkins Marine Station where they were shown around the laboratories. The dinner this evening might be described as a closing dinner. The Florida group expressed their thanks for California hospitality in verse written especially for the occasion; Mr. Sorensen responded with his well-known grace and happy choice of words; the evening was spent in enjoyable informal talk and regretful leave-taking.

Papers Presented

Wednesday, June 18

Allyn G. Smith and Mackenzie Gordon Jr.—The Marine Mollusks and Brachiopods of Monterey Bay, California, and Vicinity.

Wendell O. Gregg—Helicoid Snails of the Desert Regions of California.

Jay G. Marks—Collecting in Ecuador.

Glenn R. Webb—Notes on the mating of some *Zonitoides* (*Ventridens*) species of land-snails.

Thursday, June 19

Allyn G. Smith—A method of sealing vials for the preservation of Mollusca in alcohol.

E. P. Chace—California Land Snails and how some of them live.

Henry van der Schalie—The Michigan Pearl Button Industry.

Leo G. Hertlein—A Brief Review of Tropical West American Bivalves.

Howard R. Hill—Abnormal Shells of some Pacific Marine Mollusks.

Richard W. Foster—The preparation of a Bibliography of the Literature on Mollusk Biology.

G. Dallas Hanna—Dredging on the Mendocino County Coast.
Ralph Bolin—Illustrated Talk on Marine Life of Monterey Bay.

Friday, June 20

Earl H. Myers—Protozoans and Foraminifera.
Elmer G. Berry—A comparative study between members of the genera *Pomatiopsis* and *Oncomelania.*
Leo G. Hertlein—Remarks on Checklists.
Trevor Kincaid—Mollusks introduced into the Pacific Coast through the importation of seed oysters from Japan.
A. Myra Keen—Exhibit of rare shells received at Stanford University during the war.
A. Sorensen—Exhibit of World *Haliotis.*
Henry van der Schalie—The Land and Fresh-Water Mollusks of Puerto Rico.

LAMARCK'S PRODROME D'UNE NOUVELLE CLASSIFICATION DES COQUILLES

By HENRY DODGE

In a previous note (Nautilus, vol. 60, No. 1) I discussed briefly the historical position and importance of Lamarck's "Prodrome d'une nouvelle classification des coquilles," published in 1799.[1]

As the work is not available to most conchologists it seems that a useful purpose would be served by republishing, in translation, his Table of Genera, of which the work largely consisted. Many of the genera described are given preoccupied names. Thus it is probable that the Museum Boltenianum which appeared in the same year in which the "Prodrome" was presented to the Institut National and which was a rare and almost unknown work for years after its publication, had not been seen by Lamarck. Likewise many of the genera of the "Prodrome" have been so subdivided by later discoveries that Lamarck's descriptions are too broad to conform to our present knowledge of these groups.

[1] Memoires of the Société d'Histoire Naturelle de Paris, vol. 1, pp. 63–91, 1799. Read before the Institut National in Paris "le 21 frimaire an 7" (December 11, 1798).

In spite of these things it is hoped that the importance of this earliest list of the Lamarckian genera of shells may justify its republication.

The greatest problem in presenting an English version was whether to make a literal translation of Lamarck's language, or to use the terms employed in modern conchological English. He used an outmoded scientific vocabulary and his terminology of the different parts of the shell is often curiously archaic. The gastropods are classified according to the shape, or rather the continuity, of the aperture. He uses the indications "anterior" and "posterior" very sparingly. He seems to disregard the difference between varices and any other thickening of the shell structure or even the columellar callus. He uses the terms "bord droit" and "bord gauche" for the parietal and palatal lip and employs the word "lip" only in a few instances. It has nevertheless seemed best to translate his language literally for the most part, using modern terms only where necessary to insure clarity. After all, what we want is to see the genera as Lamarck saw them. Only in this way can we appreciate not only the advance which he made over his predecessors but also the historical significance of the very errors and confusions from which his work suffered.

I have translated the "Tableau" of genera exactly as written, adding nothing except the author and date in brackets after the name of each genus in order to emphasize Lamarck's own contributions. The punctuation is left intact except where translation required changes. The word "shell" (coquille) is omitted at the beginning of each description.

Systematic List of Genera

UNIVALVE SHELLS

(a) Single-chambered shells.

Aperture notched or open, or with a basal canal

1. CONE. *CONUS.* [Linné 1758.]

A reversed cone; narrow longitudinal aperture, edentate, base open. *Conus marmoreus.* Lin. Popular name, The Checkerboard.

2. PORCELAINE. *CYPRAEA.* [Linné 1758.]
Oval, convex, lips involute; narrow longitudinal aperture, both lips dentate. *Cypraea mappa.* Lin. Popular name, The Geographic Cone.

3. OVULE. *OVULA.* [Bruguière 1789.]
Dilated, more or less elongated at each end, lips involute; longitudinal aperture, the inner lip edentate. *Bulla ovum.* Lin.

4. TARRIÈRE. *TEREBELLUM.* ['Bolten' Röding 1798.]
Subcylindrical, apex acute; aperture longitudinal, narrow above, notched at the base; columella truncated. *Bulla terebellum.* Lin.

5. OLIVE. *OLIVA.* [Bruguière 1789.]
Subcylindrical, open at the base; the whorls of the spire separated by a canal; columella with oblique folds. *Voluta oliva.* Lin.

6. ANCILLE. *ANCILLA.* [Lamarck 1799.]
Oblong, spire low and not canaliculated; basal opening barely notched; an oblique swelling or thickening at the base of the columella. *Voluta* . . . Martin.conch.2,p.359,t.65,f.722–724.

7. VOLUTE. *VOLUTA.* [Linné 1758.]
Oval, more or less dilated medially, apex obtuse or with a mamillar nucleus, base notched but without a canal; columella crossed by folds, those below being thicker or longer. *Voluta musica.* Lin.

8. MITRE. *MITRA.* ['Bolten' Röding 1798.]
Usually fusiform or turriculate, spire with an acute apex, base notched and without a canal; columella crossed by folds, those below being the smallest. *Voluta episcopalis.* Lin.

9. COLOMBELLE. *COLUMBELLA.* [Lamarck 1799.]
Oval, spire short, base of the aperture more or less notched and without canal; thickening on the internal aspect of the outer lip; folds or teeth on the columella. *Voluta mercatoria.* Lin.

10. MARGINELLE. *MARGINELLA.* [Lamarck 1799.]
Oval or oblong, smooth, short spire, and the outer lip with a varix on its outer aspect; base of the aperture faintly notched; folds on the columella. *Voluta glabella.* Lin.

11. CANCELLAIRE. *CANCELLARIA.* [Lamarck 1799.]
Oval or subturriculate, outer lip lirate within; base of the aperture almost entire and with a very short canal;[2] columella with a few compressed and sharp folds. *Voluta reticulata.* Lin.

12. NASSE. *NASSA.* ['Bolten' Röding 1798.]
Oval; aperture terminated below in an oblique notch suggesting a canal; base of the columella partly concealing the notch and appearing obliquely truncate. *Buccinum mutabile.* Lin.

13. POURPRE. *PURPURA.* [Bruguière 1789.]
Oval, usually tuberculate or spinose; aperture terminating below in a very short canal, notched at its base; columella running to a point below. *Buccinum persicum.* Lin.

14. BUCCIN. *BUCCINUM.* [Linné 1758.]
Oval or dilated; aperture terminating below with an open notch and no canal. *Buccinum undatum.* Lin.

15. VIS. *TEREBRA.* [Bruguière 1789.]
Turriculate; aperture notched below; base of the columella twisted or oblique. *Buccinum subulatum.* Lin.

16. HARPE. *HARPA.* ['Bolten' Röding 1798.]
Oval or dilated, with sharp, parallel axial ribs; aperture notched below and without canal; columella smooth, running to a point below. *Buccinum harpa.* Lin.

17. CASQUE. *CASSIS.* [Scopoli 1777.]
Dilated; aperture longer than wide, terminated below by a short canal, curved to the left; columella wrinkled below. *Buccinum cornutum.* Lin.

18. STROMBE. *STROMBUS.* [Linné 1758.]
Swollen,[3] terminated at the base by a short canal, notched or truncate; outer lip expanding with age, with a simple wing, en-

[2] "base de l'ouverture presqu'entière et en canal très-court." A loose and confusing description for many members of this genus. The *Cancellaria* known to Lamarck contained species with an entire lip and a few with a very rudimentary canal.

[3] *Ovula, Buccinum, Harpa, Cassis* and *Bulla* are described as "bombée" (literally, arched, barreled, convex), which I have translated as "dilated." *Strombus, Pterocera, Voluta* and *Ampullaria* are described as "ventrue" (literally, big-bellied, bulging (out)), which I have translated as "swollen." The French "ventru" has the more limited meaning, comporting a swelling

tire or with a single lobe, and having a sinus below distinct from the notched base. *Strombus pugilis.* Lin.

19. PTEROCÈRE. *PTEROCERA.* [Lamarck 1799.]
Swollen, terminated below by a long canal; outer lip expanding with age, having a digitate wing and a sinus near the base. *Strombus lambis.* Lin.

20. ROSTELLAIRE. *ROSTELLARIA.* [Lamarck 1799.]
Fusiform, terminated below by a pointed canal; outer lip entire or dentate, more or less expanded into a wing with age, and with a sinus contiguous to the canal. *Strombus fusus.* Lin.

21. ROCHER. *MUREX.* [Linné 1758.]
Oval or oblong, with a basal canal, always with varices on the exterior, usually tuberculate or spinose. *Murex ramosus.* Lin. Popular name, The Chicory.

22. FUSEAU. *FUSUS.* [Lamarck 1799.[4]]
Fusiform, with a basal canal, not always with varices and having its greatest dilation either equidistant from the extremities or nearer to the base; spire high; columella smooth, outer lip without notch. *Murex colus.* Lin.

23. PYRULE. *PYRULA.* [Lamarck 1799.]
Subpyriform, with a basal canal, varices not always present, and having the greatest dilation nearer to the apex than to the base; spire short, columella smooth, outer lip without sinus. *Bulla ficus.* Lin.

24. FASCIOLAIRE. *FASCIOLARIA.* [Lamarck 1799.]
Subfusiform, with a basal canal, without varices, and with two or three very oblique, equal folds on the columella. *Murex tulipa.* Lin.

25. TURBINELLE. *TURBINELLA.* [Lamarck 1799.]
Subturbinate, with a basal canal, and with three to five folds on the columella, unequal in size, narrow and oblique. *Voluta pyrum.* Lin.

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in one area only; "bombé" signifies a general swelling, as in a globose shell. The only species to which "ventrue" should have been applied is (possibly) *Ovula.* It is impossible to find two English words conveying this difference.

[4] Not *Fusus* Helbling 1779, nor 'Bolten' Röding 1798.

26. PLEUROTOME. *PLEUROTOMA.* [Lamarck 1799.]
Fusiform or turriculate, with a basal canal, without varices, and having a notch or sinus near the top of the outer lip. *Murex babylonius.* Lin.

27. CERITE. *CERITHIUM.* [Bruguière 1789.]
Turriculate; aperture terminated below by a short, sharply recurved or abruptly truncate canal. *Murex aluco.* Lin.

Aperture entire, having at its base neither notch nor canal

28. TOUPIE. *TROCHUS.* [Linné 1758.]
Conical; aperture almost quadrangular or flattened transversely; columella oblique to the plane of the base. *Trochus niloticus* Lin.

29. CADRAN. *SOLARIUM.* [Lamarck 1799.]
Flatly conical, having an open umbilicus which is crenulated on the internal edge of the whorls of the spire; aperture almost quadrangular. *Trochus perspectivus.* Lin.

30. SABOT. *TURBO.* [Linné 1758.]
Conoidal or turriculate; aperture circular and entire, edentate; the two lips do not unite above. *Turbo marmoratus.* Lin. The Mother-of-Pearl.

31. MONODONTE. *MONODONTA.* [Lamarck 1799.]
Oval or conoidal; aperture entire, rounded and armed with a tooth formed by the truncate and projecting base of the columella; the two lips do not unite. *Trochus labio.* Lin.

32. CYCLOSTOME. *CYCLOSTOMA.* [Lamarck 1799.]
Variable in shape; aperture round or almost round; the two lips uniting to form a circle. *Turbo scalaris.* Lin. The Staircase.

33. TURRITELLE. *TURRITELLA.* [Lamarck 1799.]
Turriculate; aperture rounded, entire, but having a sinus on the outer lip.[5] *Turbo terebra.* Lin.

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[5] The sinus noted by Lamarck is found only in the shells of Section (Subgenus?) *Torcula* Gray 1847. It is therefore not a generic trait of *Turritella sensu lato.* Lamarck probably based his mention of a sinus upon *Turritella* (*Torcula*) *exoleta* (Linné), as it is certainly not found in any of the species of *Turritella sensu strictu,* in which restricted group his "example" is included.

34. JANTHINE. *JANTHINA.* ['Bolten' Röding 1798.]
Sub-globose, diaphanous; aperture triangular; an angular sinus on the outer lip. *Helix janthina.* Lin.

35. BULLE. *BULLA.* [Linné 1758.]
Dilated, spire sunken, outer thin and sharp; aperture as long as the shell, no basal umbilicus. *Bulla ampulla.* Lin. The Nutmeg.

36. BULIME. *BULIMUS.* [Scopoli 1777.]
Oval or oblong; aperture entire, longer than wide, columella smooth, without folds, not truncated and without any spreading (évasement) of the base. *Bulimus haemastomus.* Scop.delic.1. t.25,f.1,2.

37. AGATHINE. *ACHATINA.* [Lamarck 1799.]
Oval or oblong; aperture entire, longer than wide; columella smooth, without folds, but truncate at its base. *Bulla achatina.* Lin.

38. LYMNÉE. *LYMNAEA.* [Lamarck 1799.]
Oblong, subturriculate; aperture entire, longer than wide; the lower portion of the outer lip rising as it becomes reentrant into the aperture, and forming a very oblique fold on the columella. *Helix stagnalis.* Lin.

39. MELANIE. *MELANIA.* [Lamarck 1799.]
Turriculate; aperture entire, oval or oblong, spreading at the base of the columella. *Helix amarula.* Lin.

40. PYRAMIDELLE. *PYRAMIDELLA.* [Lamarck 1799.]
Turriculate; aperture entire, semi-oval; columella projecting and having three oblique folds, perforated at its base. *Trochus dolabratus.* Lin.

41. AURICULE. *AURICULA.* [Lamarck 1799.]
Oval or oblong; aperture entire and longer than wide, narrowed at the top; one or more folds on the columella, independent of the crossing of the columella by the outer lip (indépendans du bord droit remontant sur le gauche). *Voluta auris midae.* Lin.

42. AMPULLAIRE. *AMPULLARIA.* [Lamarck 1799.]

Globose, swollen, umbilicate, without a callus on the parietal lip; aperture entire, longer than wide. *Helix ampullacea.* Lin. The Cordon bleu.

43. PLANORBE. *PLANORBIS.* [Müller 1774.]

Discoidal, with flat or sunken spire; aperture entire, longer than wide, notched laterally by the convex projection of the penultimate whorl. *Helix cornu arietis.* Lin.

44. HELICE. *HELIX.* [Linné 1758.]

Globose, or orbicular, spire convex or conoidal; aperture entire, wider than long, notched above by the convex projection of the penultimate whorl. *Helix nemoralis.* Lin.

45. HELICINE. *HELICINA.* [Lamarck 1799.]

Suglobose, imperforate; aperture entire and semi-oval, columella callous, narrowed below. . . .

46. NERITE. *NERITA.* [Linné 1758.]

Semi-globose, flattened below, not umbilicate; aperture entire, sub-circular; the columella slightly oblique. *Nerita exuvia.* Lin.

47. NATICE. *NATICA.* [Scopoli 1777.]

Semi-globose, umbilicate, the parietal lip calloused in the region of the umbilicus; aperture sub-circular; columella oblique and edentate.[6] *Natica canrena.* Lin.

48. SIGARET. *SIGARETUS.* [Lamarck 1799.]

Oval, depressed, almost auriform, with a short and helicoid columella; aperture entire, very large, widening toward the top of the outer lip, longer than wide. *Helix haliotoidea.* Lin.

49. STOMATE. *STOMATIA.* [Lamarck 1799.]

Oval, auriform, spire prominent; aperture large, entire, longer than wide; disk imperforate. *Haliotis imperforata.* Chem.10, t.166,f.1600,1601.

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[6] There is considerable evidence that Lamarck's *Natica* is not the *Natica* of Scopoli 1777, but that it embraces merely the so-called *canrena* group, the members of which are closely allied species if not actually varieties or subspecies of *canrena* Linné. *Naticarius* Duméril 1805 is a more appropriate name for this group. *Canrena* Linné is the type of both *Naticarius* and *Natica* Lamarck, by monotypy. *Natica* Scopoli, on the other hand, has as genotype *Nerita vitellus* Linné.

50. HALIOTIDE. *HALIOTIS.* [Linné 1758.]

Flattened, auriform, with a very low spire; aperture very large, longer than wide; disk pierced with holes in a line parallel to the inner lip. *Haliotis tuberculata.* Lin. Sea-ear.

51. PATELLE. *PATELLA.* [Linné 1758.]

Shield- or cap-shaped, spire not complete, entire at the apex [i.e. not perforate], concave and simple below. *Patella granularis.* Lin. The Goat's eye.

52. FISSURELLE. *FISSURELLA.* [Bruguière 1789.]

Shield-shaped, spire lacking, concave below, pierced at the apex with an oval or oblong hole. *Patella nimbosa.* Lin. The Key-hole.

53. CREPIDULE. *CREPIDULA.* [Lamarck 1799.]

Oval or oblong, convex above, and with a rudimentary spire, inclined towards the edge of the shell; the inside is partially closed-off by a simple diaphragm which is not in the form of a spiral. *Patella fornicata.* Lin.

54. CALYPTRÉE. *CALYPTRAEA.* [Lamarck 1799.]

Conoidal, with a vertical apex, entire and pointed; the inner side is furnished with a tongue-like member which is horn-shaped or with a spiral diaphragm. *Patella chinensis.* Lin.

55. DENTALE. *DENTALIUM.* [Linné 1758.]

Tubular, regular, an elongated cone, slightly curved, and open at both ends. *Dentalium elephantinum.* Lin.

56. VERMICULAIRE. *VERMICULARIA.* [Lamarck 1799.]

Tubular, symmetrically spiral at apex, and entire for its whole length; aperture sub-circular. *Serpula lumbricalis.* Lin.

57. SILIQUAIRE. *SILIQUARIA.* [Bruguière 1789.]

Tubular, spiral near its apex, and divided laterally along its entire length by a narrow slot; aperture sub-circular. *Siliquaria anguina.* Lin.

58. ARROSOIR. *PENICILLUS.* [Bruguière 1789.[7]]

Tubular, slender and loosely spiral at its apex, the anterior portion being club-shaped and terminated by a convex disk furnished with perforated tubes. *Serpula penis.* Lin.

[7] Preoccupied by *Penicillus* Guettard 1770, a genus of marine worms. The first validly proposed name for this group of the *Clavagellidae* is *Aspergillum* Lamarck 1818.

59. ARGONAUTE. *ARGONAUTA.* [Linné 1758.]

Very thin, boat-shaped, involute, spire reentrant in the aperture, the keel double and tuberculate. *Argonauta argo.* Lin. The Paper Nautilus.

(b) Multi-chambered shells.

60. NAUTILE. *NAUTILUS.* [Linné 1758.]

Spiral, sub-discoidal, the last whorl enveloping the others, walls simple; chambers numerous, formed by simple transverse partitions, the disks of which are perforated by a tube. *Nautilus pompilius.* Lin.

61. NAUTILITE. *NAUTILITES.* [Lamarck 1799.]

Spiral, subdiscoidal, the last whorl enveloping the others, walls articulated by sinuous sutures; partitions transverse, lobed in outline and pierced by a marginal tube. *N.*

62. AMMONITE. *AMMONITES.*

[Gessner 1758, Bruguière 1789.]

Spiral, discoidal, whorls contiguous, with walls articulated by sinuous sutures; partitions transverse, lobed and clearly defined in outline, and pierced by a marginal tube. *Ammonites* . . . Brug.dict.List.Conch.t.1044.

63. PLANORBITE. *PLANORBITES.* [Lamarck 1799.]

Spiral, discoidal, whorls contiguous, walls simple; partitions transverse, entire, closely spaced. *Pl.*

64. CAMERINE. *CAMERINA.* [Bruguière 1789.]

Lenticular, discoidal, walls simple, concealing all the whorls; chambers numerous, formed by imperforate transverse partitions. *Camerina laevigata.* Brug. The Coin-stone.

65. SPIRULE. *SPIRULA.* [Lamarck 1799.]

Partially or completely spiral, at least the last whorl is not contiguous with the others; chambers transverse, simple, the disks being pierced by a tube. *Nautilus spirula.* Lin.

66. BACULITE. *BACULITES.* [Lamarck 1799.]

Straight, cylindrical, subconical; walls articulated by sinuous sutures; partitions transverse, imperforate, lobed and clearly defined in outline; no tube nor external spout. *B.*

67. ORTHOCÈRE. *ORTHOCERA.*

[Bruguière 1789 (*Orthoceras*).]

Straight or arcuate, subconical; chambers distinct, formed by transverse partitions, simple, perforated by a tube which is either central or lateral. *Nautilus raphanus.* Lin.

68. ORTHOCERATITE. *ORTHOCERATITES.*

[Gessner 1758, Lamarck 1799.]

Conical, straight or arcuate, provided internally with transverse partitions, and with two longitudinal, obtuse and converging "stops" (Fr. arrêtes); the last chamber closed by an operculum. . . .

69. BELEMNITE. *BELEMNITES.*

[Gessner 1758, Lamarck 1799.]

Straight, in the form of a long cone, pointed, filled in at the apex, provided with a lateral siphon; a single conical chamber is visible, the earlier ones having been successively filled in by the multiplication of partitions. . . .

NOTES AND NEWS

Erratum.—Naut. 61 (1): 16. Explanation of Figure 2, p. 17, read, "Lateral view of carrefour and albumen gland" *not* "Lateral view of carrefour and kidney."—Charles B. Wurtz.

Arion ater (L.) in Oregon.—This large European slug has recently been received from Gresham, Oregon, collected by Mr. Joe Schuh, June 11 of this year. The specimens (No. 574216 U. S. National Museum) are the color-variety *aterrima* Taylor, in which not only the upper parts are black, but the entire sole also. The collector reported that it "exuded an iridescent purplish slime."—H. A. Rehder.

Brevimalleus, New Name for *Fundella* De Gregorio.—The name *Fundella* was proposed in 1884 by De Gregorio in Bull. Soc. Mal. Ital., Vol. 10, p. 73, pl. 4, fig. 6. The genotype, by original designation, is *Fundella lioyi* De Gregorio. This species seems to be indistinguishable from *Avicula candeana* d'Orbigny. De Gregorio's name is preoccupied by *Fundella* Zeller 1848, which was proposed for a group of Lepidoptera. Dall's

statement regarding *Electroma* Stoliczka 1871 (type *Avicula smaragdina* Reeve) that the group "may be represented in the recent fauna of the Antilles by *Avicula candeana* d'Orbigny, which seems to owe its characters to commensalism with sponges" is in error as this genus is more closely allied to the typical Pterias than is *Brevimalleus*.—R. A. McLean.

A new record for Drymaeus multilineatus Say.—Mr. and Mrs. Leo Burry turned over to me for study a pair of *D. multilineatus* Say which they collected alive on an Indian mound located on their property at Pompano Beach, Florida. The specimens are somewhat larger than those measured by Pilsbry in his Land Mollusca of North America, 1946, 2, pt. 1, p. 26. This locality is about 25 miles north of Arch Creek, the northern most locality given by Pilsbry for the southeast coast of Florida. Our specimens measured 23 by 10.5 and 24.5 by 11.2 mm.—W. J. Clench.

Littorina littorea in New Jersey.—Since the publication of "*Littorina littorea* on the New Jersey Coast" (Nautilus, vol. 60, no. 3, January, 1947, pp. 73–76), additional information has come to my attention. In "The Animal Life of our Sea Shore" by Angelo Heilprin, the species of periwinkles now called *Littorina irrorata* (Say), *Littorina obtusata* (Linné) and *Littorina saxatilis* (Olivi) are listed as inhabitants of the coast of New Jersey. In a footnote to page 24, the author says "since the above was written *Littorina littorea* has been found at Atlantic City." This book published in 1888 contains probably the earliest reference to *Littorina littorea* in New Jersey. Henry A. Pilsbry reported colonies of this species flourishing at both Atlantic City and Point Pleasant in his booklet "Sea Shells of the Jersey Shore," 1891. In April, 1947, I found a colony of *Littorina littorea* living on the flats at the end of the highway bridge across the channel directly in back of Longport.—Robert C. Alexander.

Clessin's section of Planorbis armigerus.—In the July number of The Nautilus (p. 30), Dr. Morrison attempted to displace the generic name *Tropicorbis* Pilsbry & Brown (1914) by adoption of "*Armigerus* Clessin, 1884." But Clessin (p. 120)

in the sentence "Die Art gehört zur Sect. Armigerus, welche durch in Innern des Umgänge angebrachte Zähne und Lamellen ausgezeichnet ist" actually was stating, in his usual clumsy way, that *Planorbis albicans* (and *P. alexandrinus*) belonged in the section of *P. armigerus* Say (p. 121). Even if "*Armigerus* Clessin, 1884" were a valid name, which I doubt, its type by absolute tautonymy would be Say's species. This would make it a superfluous synonym of *Planorbula* Haldeman, as Clessin (p. 122) himself indicated.—H. Burrington Baker.

Ensis directus in Lake Worth, Florida.—During the latter part of June I collected a number of specimens of this shell in the northern portion of Lake Worth. The shells were projecting an inch or two from their holes and although dead contained the animals. Extensive dredging in the vicinity had deposited a layer of mud several inches thick over the bottom of the lake and apparently the *Ensis,* as well as numerous other bivalves, had come to the surface in an effort to obtain clear water, only to be smothered. I believe this is the first record of *Ensis directus* in Lake Worth.—A. Hyatt Verrill.

Unrecorded habit of Cymatium cyncocephalum.—During the latter part of July Mrs. Verrill and myself discovered a large colony of this rare shell in Lake Worth. The shells, together with *Cymatium tuberosum, Cymatium chrysostoma* and *Cymatium gracile,* were living buried in mud in shallow water, each shell having a small pit or crater. Each of these pits was partly filled with small bivalves, each neatly drilled. Many of the pits were deserted or at least unoccupied, apparently indicating that the *Cymatium,* having exhausted the supply of bivalves in one small area, moved to another location. Over thirty *cynocephalum* and many specimens of the other species were collected within an area of a few hundred square feet. I do not think this habit of the cymatiums has been recorded hitherto.—A. Hyatt Verrill.

THE NAUTILUS

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BRINGING IN THE TROCHUS IN THE PALAU ISLANDS

By JULIA GARDNER[1]

The Palau Islands, lying about 500 miles east in the Philippines in the South Pacific, are partially enclosed within a great barrier reef which is best developed along the western side of the group. The waves from the open sea pound against the saw-tooth margin of the reef and break into white spray forming a breaker or surf line which is visible for a long distance at sea, and for an even greater distance from the air. Beyond the surf line, the reef slopes steeply to ocean depths. The reef margin, continually washed by the surf, offers optimum conditions for a diverse fauna and, to a lesser degree, a marine flora.

One of the several molluscan species in the Palauan fauna is *Trochus niloticus* Linnaeus, commonly known as Trochus or Trocas, and by the island natives as Takase-gae. The shell of the Trochus is commercially valuable for button-making, and the market is so well established that the species was protected by Japanese conservation regulations. The meat of the Trochus, although edible, is tough and is used only in time of food shortage.

Trochus is occasionally seen on the reef flat but it thrives only at the reef margin. The spawning season is reportedly between January and March and again between July and September. Regulations formerly limited the taking of Trochus to the month of May. Fishing during the war years was so reduced that in 1947 the season was extended to the middle of September. Three years are required for the growth of the shell

[1] Published with the permission of the Director, Geological Survey, United States Department of the Interior.

and only those that have reached a basal diameter of at least 3 inches may be taken.

Most of the Trochus brought in by the fishermen are from barracuda-infested waters at a depth of 30–40 feet, possibly because the shallower and more easily accessible depths have been too much hunted. The natives dive for the Trochus in the very early morning when the animals are pasturing on the seaweed and are very active. The catch is brought back over the reef and buried either in the sand or in shallow water where scavengers such as ants and crabs will eat out the soft parts. The fishermen later collect the shells in canoes at low tide.

The shells are often heavily encrusted with a layer of calcareous algae or similar material which must be removed before marketing. Several techniques are used. Two shells can be rubbed together. Sharp taps with the back of the blade of a heavy native knife, or with the blade itself, will often remove the encrustations. The finer extraneous material can be removed by hard rubbing with cocoanut husk or wire brush.

The shells are marketed at the end of the collecting season. Each village is assigned certain days on which to bring the harvest to Koror, the headquarters of the U. S. Commercial Company, and the occasion is in the nature of a social event. All manner of containers are used for bringing in the shells—wire traps, copra sacks, old sand bags, and large, shallow baskets woven of cocoanut leaves. The boatmen are usually the older more experienced ones who know how to sew up the bags of Trochus after weighing, and the stronger ones who can stack them to the top of the high warehouse. Sometimes the men sing with a strong and insistent rhythm as they swing the sacks into place.

In 1946, more than 791,000 shells were brought in to Koror and in 1947 the number is expected to exceed one million. The most shells brought in by any one individual in 1946 was 13,652. He was probably one of a large family, for the usual number per man is about one thousand. The average weight of each shell is three-quarters of a pound. In 1946, the price paid was 5 cents per pound; in 1947, a price of 6 cents a pound is expected. The Trochus shells are by no means the only source of income for the natives, but they furnish a substantial portion.

After the shells have been both counted and weighed, they are sacked and loaded on boats to be taken to Osaka where they are cut into buttons and sold on the Ginza. As many as 50 buttons can be obtained from a single shell. Even the bits of shell remaining after the buttons are cut are utilized, either for decorative lacquered surfaces or as irritants in pearl culture.

A NEW GENUS AND SPECIES OF PHILIPPINE AMNICOLIDAE *

By R. TUCKER ABBOTT

Assistant Curator, Division of Mollusks, United States National Museum

During a war time survey of molluscan intermediate hosts in the Philippine Islands where the oriental blood fluke disease, schistosomiasis, is endemic, an exceedingly curious mollusk was collected in two localities on Leyte Island, Philippine Islands. No previous description of this species could be found in the literature, and since its shell and animal possess such unique characters, unparalleled in the family Amnicolidae, we are here formally describing a new genus and its genotype species.

This mollusk was first discovered on VJ day in the slightly brackish region of the San Joaquin River, two miles inland, on the eastern coast of Leyte. Several dozen specimens were found by screening the black ooze in shallow water at the banks of the sluggish river. Normally, this minute snail crawls about on the shaded underside of rotting nipa palm fronds, but when disturbed, withdraws quickly into its shell and falls to the muddy bottom. Observations under the dissecting microscope showed that all individuals progressed with a slight crablike gait, the axis of the head and foot being some 30° to the right of the direction of forward progression. Probably correlated with this is an asymmetrical color pattern on the head and a series of serrations found only on the left tentacle (fig. 1). When nudged, the animal withdraws into its shell with explosive rapidity which often causes the shell to overturn. This last characteristic is even more pronounced in the *Stenothyra* which

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also occupy the same micro-habitat. Other mollusks collected with *Clenchiella* were *Thiara* (*Plotiopsis*) *scabra* Müller, *Syncera, Neritina* and *Cerithidea.*

Clenchiella new genus

Monotypic genotype: *Clenchiella victoriae*

A taenioglossate prosobranch gastropod whose minute planorbid shell (4.0 mm. in diameter) closely resembles in form *Valvata tricarinata* (Say). It is dioecious, with the males bearing a three-pronged verge attached slightly to the right side of the back. The gills are welded to the left side of the mantle, well developed, with about 25 gill lamellae. The tentacles are fairly long with the eyes located at the bases on slight swellings. Mantle edge smooth. Anterior edge of foot distinctly bilobed and auriculate with a pronounced, bulbous mucus gland embedded on the median dorsal surface. Operculum round, thin, corneous, a modified paucispiral in which the whorls have tightened up to form an almost multispiral pattern. The nucleus is central and reinforced internally by a pimple-like thickening. The operculum can be withdrawn into the aperture for ⅛ of a shell whorl. Periostracum of the shell relatively thick. Radula taenioglossate with a dentition count of $\frac{4\text{–}1\text{–}4}{1\text{–}1\text{–}1}$; 2–1–3; 18; 20.

Clenchiella victoriae new species (Plate 5, figs. 1–7).

Shell very small (maximum diameter 4.0 mm.), almost discoidal, fairly thin, strongly bicarinate, and openly umbilicate. Spire slightly sunken. Nuclear whorls 1½ in number and smooth. Postnuclear whorls 2½ to 3 in number, increasing rapidly, rounded except for two prominent carinae, one of which is located on the middle of the upper surface, the other on the middle of the lower surface or base of the shell. Periphery of whorl oval or nearly U-shaped. Suture well indented. Last whorl just behind the aperture drops slightly. Aperture round, slightly constricted, and thickened internally by a slight rim. A slightly thickened varix is found externally a little way back from the lip. Spiral sculpture, in addition to the two prominent carinae, consists of many minute raised threads which are of periostracal origin. Umbilicus wide and very deep. Periostracum relatively thick and in life colored a bright translucent red, but in dead shells is blackish brown. Color of the shell chalky white. The operculum is round, thin, corneous, a modified paucispiral in which the whorls have tightened up to form an almost multispiral pattern. The nu-

cleus is central and reinforced internally by a pimple-like thickening.

Holotype: Maximum diam. 4.0 mm.; maximum alt., 1.5 mm.
Paratype: Maximum diam. 4.2 mm.; maximum alt., 1.7 mm.

Animal.—Small and capable of being completely retracted into the shell. Foot tapering posteriorly, the anterior end bilobed with the lateral extremities recurved as shown in figures 1 and 3. Anterior edge of foot with a narrow, fairly deep slit which is supplied with mucus from a prominent raised mucus gland embedded in the dorsal surface of the foot underneath the proboscis (figures 2 and 3). Head relatively small; proboscis short, bilobed in front. Single tentacle on each side of head fairly long, slender, and swollen at the outer base where the small black eye is located. The left edge of the left tentacle near the base bears 6 to 7 distinct serrations. These are absent on the right tentacle. Minute cilia which pass a current of water towards the mantle cavity are found only on the left tentacle. In males the verge is located on the right dorsal side of the body well behind the right tentacle. The verge bears three prominent bulbous appendages, the narrowest of which bears the sperm duct internally. The verge is coiled dextrally for one half turn while not in use. Mantle thin with a slightly thickened border. Gills 25 to 27 in number, welded to the left side of the mantle. The lamellae at the anterior end of the gill series do not reduce in height as in most prosobranchs, but actually become higher and narrower as is shown in figure 9.

Color of animal in life bright. The most distinguishing color marking is the soot black, short bar near the end of the tentacle (see drawings). Light orange dots are embedded in the tentacles and just above the right eye. The proboscis is entirely soot black except for a translucent white anterior margin and a broken clear streak on the dorsal surface. The top of the head is asymmetrically colored with dark gray to black as shown in figure 1. On the right side of the body only are four prominent oblong gray patches above which runs a slight groove of a light cream color. Sides of foot translucent whitish with an occasional yellow or orange dot embedded in the skin. Penis not colored except for a few whitish granules embedded in the

largest non-functional lobe. Mantle irregularly splotched with clouds of black specks.

Radula taenioglossate with seven different rows of teeth. The formula as shown in figure is $\frac{4\text{–}1\text{–}4}{1\text{–}1}$; 2–1–3; 18 to 20; and 27 to 29. The lateral occasionally has a dentition count of 3–1–4 (see figure 7).

Type locality.—San Joaquin River, 2 miles north of Tanauan, eastern side of Leyte Island, Republic of the Philippines. R. T. Abbott, collector, August 14, 1945.

Types.—From the above locality: holotype U.S.N.M. No. 488534, paratypes: U.S.N.M. No. 488535. Paratypes also deposited in the Mollusk Department of the Museum of Comparative Zoölogy at Harvard College, Academy of Natural Sciences of Philadelphia No. 183548, Museum of Zoology at Ann Arbor, Chicago Museum of Natural History, and the Carnegie Museum.

Locality records.—The type locality and the estuary southeast of Abuyog, eastern side of Leyte Island, Republic of the Philippines (paratypes, U.S.N.M. No. 488536). This species may be widespread throughout the Philippines.

Ecology and habits.—In the main, this was discussed in the introduction. The temperature of the water was 81° F, the pH 7.6. A salinity test was not made, but the plants and animals found in this part of the river would indicate that backing tides occasionally increased the salinity, while rainy spells probably made the water entirely fresh. Deep shade and quiet, warm water were characteristic of both localities where this species was collected. Natural enemies were not observed, although the remarkable alertness of the animal and its power of explosive withdrawal would suggest that a defense had been developed against predatory fish or crustacea. Eggs were not located. Under the microscope, a male was seen to crawl on to the shell of the female, lean forward over the aperture edge of the female shell, and plunge its verge into the mantle cavity of the female. In doing so, the male flopped its shell and body upside down in front of the female and remained in this copulatory position for over five minutes.

Taxonomic relationships.—The genus *Clenchiella* is placed in

the family Amnicolidae and in the subfamily Amnicolinae (=Hydrobiinae) with some hesitation. The shell and operculum of *Clenchiella victoriae* are strikingly similar to members of the Valvatidae but the animal excludes it from that group, which possesses a fairly long, plumose gill free at its distal end. In addition, the Valvatidae are hermaphroditic while *Clenchiella* is dioecious. *Clenchiella* is more closely related to American Amnicolids than to other Philippine Amnicolids such as *Oncomelania, Digoniostoma* and *Bulimus*. The foot is not unlike West Indian *Potamopyrgus,* and the verge resembles in general the type found in *Somatogyrus subglobosus* Say of the Great Lakes in the United States. The closest allies in animal characters that *Clenchiella* has in the Philippines are among the Stenothyrinae which have the same shape of foot and similarly bizarre color patterns. This latter group, however, has two characters not found in *Clenchiella* but which are common to some Rissoidae: (1) a tube-like fleshy appendage on the dorsal and posterior part of the foot; (2) a strong reinforcement, usually horseshoe-shaped, on the operculum on the side of muscular attachment. The bulbous mucus gland so prominently displayed on the dorsal surface of the anterior end of the foot of *Clenchiella* is found only in one other group of freshwater mollusks, the amphibious Synceridae (=Assimineidae), but this latter group is distinctive in its lack of tentacles (reduced to stubby eyestalks) and the absence of gill lamellae which are replaced by a gill sac. The radula of *Clenchiella* does not exclude it from either the Stenothyrids or Amnicolids. Until a more thorough anatomical study is made on allied groups, it is perhaps best not to erect a new subfamily at this time.

The genus is named after William J. Clench, Curator of the Department of Mollusks at the Museum of Comparative Zoölogy at Harvard College, which donated a large and valuable collection of medically important mollusks to Commodore Thomas River's Naval Medical Research Unit-2 during the war. The species which was collected on VJ day is named in commemoration of the victory won by our armed forces.

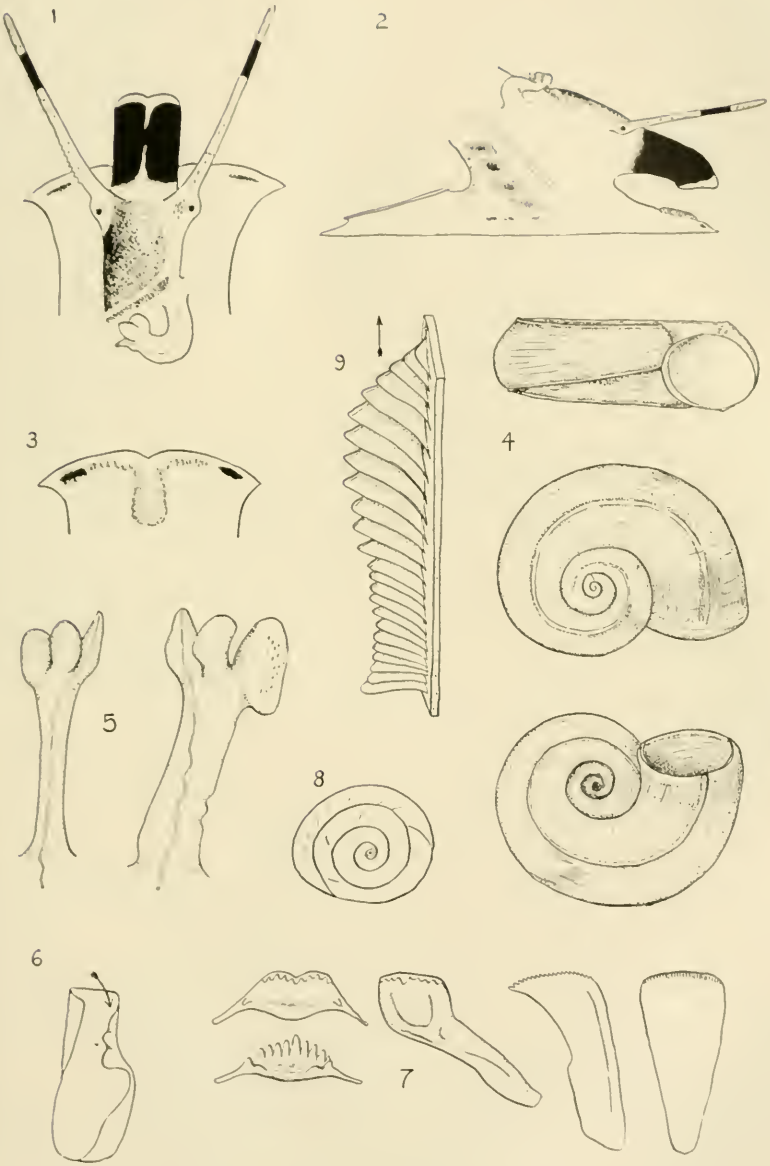
Explanation of Plate, Clenchiella victoriae

Figure 1. Dorsal view of anterior half of living animal when crawling. × 50.
Figure 2. Right lateral view of crawling animal. × 40.
Figure 3. Dorsal view of anterior end of foot showing central mucus gland and two lateral black color markings. × 50.
Figure 4. Apertural, apical and umbilical views of shell. × 35.
Figure 5. Two views of external verge in living male showing functional lobe with spermatheca and two non-functional lobes. × 100.
Figure 6. Thin, transparent lining to stomach. Arrow shows direction of entering food. × 80.
Figure 7. Radula: rachidian, lateral, inner and outer marginals from left to right. Rachidian shown from two angles.
Figure 8. Operculum. × 40.
Figure 9. Semi-diagrammatic drawing of gill lamellae welded to the left side of the mantle. Arrow points posteriorly towards heart. × 60.
(Enlargements approximate)

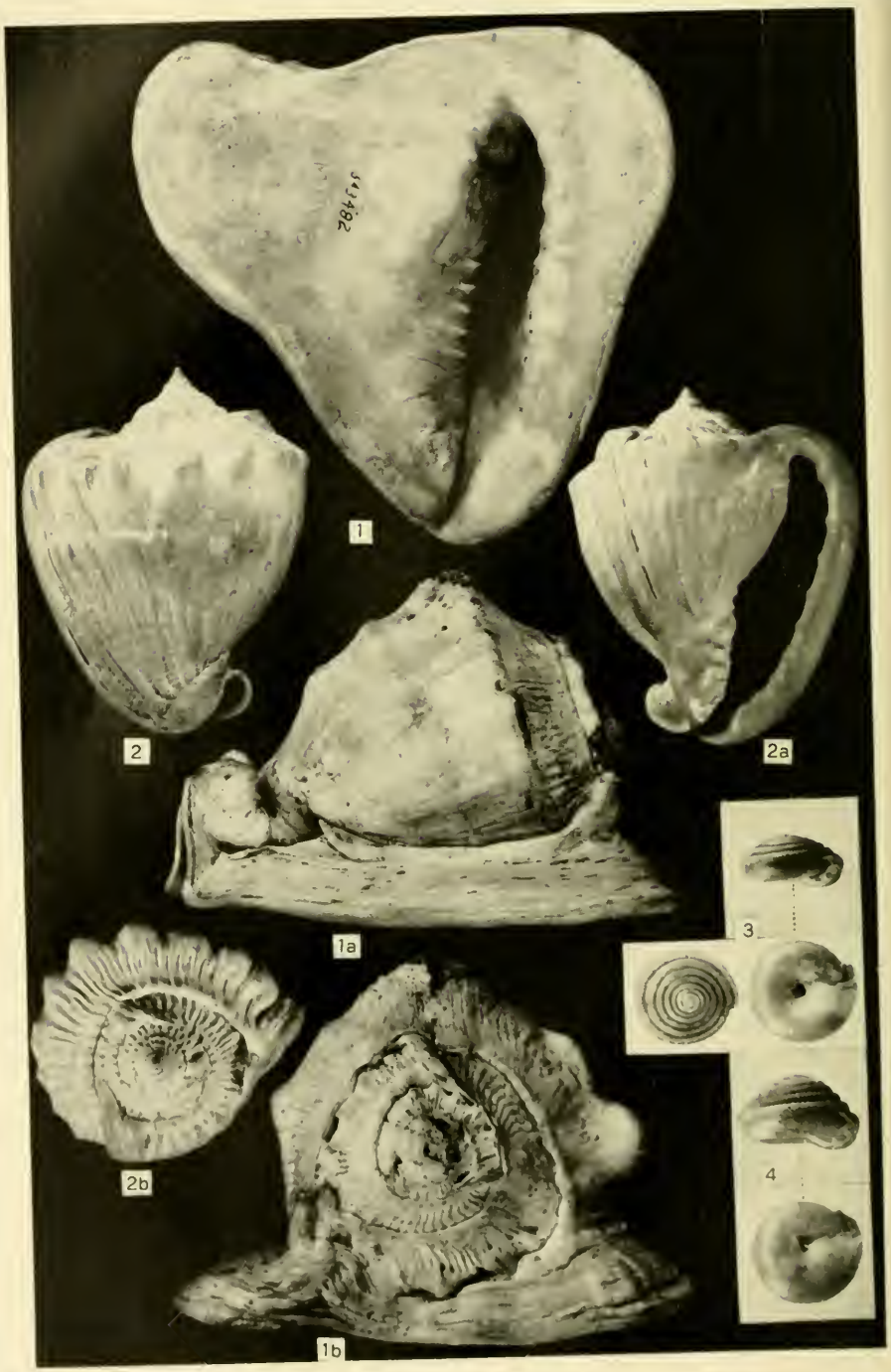
SOME LAND SNAILS FROM WEST VIRGINIA WITH DESCRIPTION OF A NEW SPECIES

By CHARLES B. WURTZ

The geographic position of West Virginia in the Appalachian Mountain Range and the features of its physiography make it a particularly desirable collecting ground for the student of land snails. This has been appreciated by many workers, but unfortunately few have had an opportunity to enter this field. Dr. S. T. Brooks and Gordon K. MacMillan (earlier as G. M. Kutchka) of the Carnegie Museum initiated a program of study in West Virginian mollusks about twelve years ago. The contributions of their studies are embraced in a number of papers. Brooks (Annals Carn. Mus., 24: 61–68, 1935) published a list of the shelled mollusks of West Virginia in the Carnegie Museum collection. Together they then published on the occurrence of the Carychiidae (loc. cit., 25: 155–161, 1937) and the Pupillidae (loc. cit., 27: 63–83, 1938) in the state. In 1937 (Naut., 50 (3): 97) Dr. Brooks added to the list of records of Pupillidae in West



ABBOTT: CLENCHIELLA VICTORIAE



FIGS. 1 2b, CASSIS DELTA Parker. FIG. 3, GASTRODONTA FONTICULA Wurtz. FIG. 4, G. INTERNA (Say).

Virginia. Brooks and G. R. Hunt described *Vertigo clappi* (Annals Carn. Mus., 25: 121–122, 1936) from West Virginia and *Triodopsis platysayoides* was described by Brooks (Naut., 46 (2): 54, 1933) from Cooper's Rock, W. Va. In 1940 (Naut., 53 (3): 95) Brooks and MacMillan described *Pomatiopsis praelonga* and *Triodopsis tridentata rugosa* (=*Triodopsis rugosa*) from Clay County and Logan County respectively.

The recent war apparently caused an interruption of their program. Mr. MacMillan is, however, still at the Carnegie Museum, and still very much interested in West Virginian Mollusca. In a recent conversation with him I found that a manuscript had been prepared and submitted prior to the war but that it has not yet been published. It embraces all the land snails excepting the Carychiidae and Pupillidae which were treated earlier. Most of the locality records contained here were long ago made available to Mr. MacMillan and, presumably, they are included in the unpublished manuscript mentioned.

Southeastern United States has long been recognized as a center for the Post-Pleistocene dispersal of plants and animals. During the Pleistocene epoch there were apparently three refuges in the southern states from which the main elements of our fauna spread northward as conditions permitted. These refuges were the southern end of the Blue Ridge Province, i.e., the Great Smokies; the Cumberland Plateau; and the Ozark Plateau. Each of these three areas are not only physically distinct, but faunistically distinct. Many forms are peculiar to only one of the three especially at the species level, and not uncommonly at the generic level.

The bulk of West Virginia lies in the Kanawha section (also called the Unglaciated Allegheny Plateau) of the Appalachian Plateau. This is a mature plateau of moderate to strong relief. This Kanawha section is the northward extension of the Cumberland Plateau section, and is more or less arbitrarily stated to have its southern limit about the center of Kentucky. Eastern West Virginia (not considered herein) extends into the Valley and Ridge Province which is a relatively narrow belt of second-cycle mountains separating the Appalachian Plateau from the Blue Ridge Province. The Kanawha section of the Appalachian Plateau, so poorly known by the malacologists, probably repre-

sents a distinct route of northward advance from the Cumberland Plateau refuge. Throughout West Virginia and southwestern Pennsylvania there seems to be a mixing of the elements of this refuge and the northward moving forms from the Great Smokies refuge. Through Tennessee and Alabama the Valley and Ridge Province seems to still represent a geographic and ecologic barrier to the spread of many forms between the plateaus and mountains. North of Tennessee, however, this effect seems to have broken down somewhat. Actually too little is known from West Virginia to justify any general statement.

The material presented here is the product of a number of field trips of varying lengths. Probably the most interesting material is that from Hudnall on Paint Creek in Kanawha County. Two trips were taken into this area. These trips were made in June of 1937 and 1938. The method of transportation is a familiar one. It consisted of standing at the side of the appropriate highway with the right arm, fist, and thumb extended, and with what was meant to be a charming smile on the face. At that time such methods were effective although the amount of baggage was decidedly limited. Later collections, from the other counties, were effected by using a one-half ton truck of questionable parentage and unquestionable antiquity. In a few instances the records are the work of another person and these are indicated by the familiar " !"

Where details concerning the collection station have been included they have been included only under the first reference to the station. E.g., all references to Hudnall, Kanawha County are to the wooded hillsides on the eastern side of Paint Creek. This avoids needless repetition.

Where duplicate material has occurred it has been deposited in the collection of the Academy of Natural Sciences of Philadelphia.

The only fresh water mollusks collected were some Planorbidae from Paint Creek, Hudnall. Since these have never been studied they are not included.

Amnicolidae

Pomatiopsis lapidaria (Say). Marion County, Smithville. This was at the lower edge of the town along the Monongahela River.

Carychiidae

Carychium exile (Lea). Kanawha County, Hudnall.

Carychium nannodes Clapp. Kanawha County, Hudnall. Found as a mixed population with *C. exile*. This is a common occurrence with these two species, and Dr. Clapp even mentions it in the description of *C. nannodes* (Naut., 19 (8): 91, 1905).

Carychium exiguum (Say). Marion County, Smithville.

Polygyridae

Stenotrema edvardsi (Bland). Kanawha County, Hudnall.

Stenotrema stenotrema (Pfeiffer). Cabell County, Milton. In planks and stones which bordered a dirt road along a hillside. In these shells the apical whorls had been broken away, possibly by a mouse. The basal noteh of these individuals is shallow. Kanawha County, Hudnall.

Stenotrema hirsutum (Say). Cabell County, Milton; Harrison County, Wolf Summit; Kanawha County, Hudnall; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling; Putnam County, Red House and also at Buffalo. The latter station was a very steep hillside covered with leaf mold. Tyler County, Friendly.

Stenotrema fraternum (Say). Kanawha County, Hudnall; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling; Tyler County, Friendly.

Mesodon thyroidus (Say). Brooke County, Bethany. R. Darsie!; Cabell County, Milton; Kanawha County, Hudnall; Marion County, Smithville; Ohio County, Oglebay Park in Wheeling; Putnam County, Red House; Tyler County, Friendly. Only one specimen and it has the lower edge of the peristome deformed. Wetzel County, New Martinsville. Beside the cemetery. Wood County, two miles north of Boaz (ten miles north of Parkersburg) on the Henrie Farm along Rt. 21. There is a flood plain here which had been flooded four years earlier (in 1937). The only snail found that had subsequently moved into this area was *Anguispira alternata* (Say).

Mesodon mitchellianus (Lea). Brooke County, Bethany. R. Darsie!; Ohio County, Oglebay Park in Wheeling.

Mesodon zaletus (Binney). Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling.

Mesodon pennsylvanicus (Green). Marion County, Smithville; Ohio County, Oglebay Park in Wheeling.

Mesodon appressus (Say). Cabell County, Milton; Kanawha County, Hudnall. Found on the ceilings of old coal mines which were no longer being mined. At the time there had been rain for several days. Also one specimen was found along the Kanawha River on a railroad embankment opposite Montgomery.

Mesodon sayanus (Pilsbry). Kanawha County, Hudnall. Two specimens which are not quite mature. The teeth are absent although one shell has the peristomal reflection completed. Monongalia County, Cooper's Rock State Park.

Triodopsis tridentata (Say). Cabell County, Milton. Similar to the Hudnall individuals and the three large ones from Oglebay Park in Wheeling. Brooke County, Bethany. Also from Williamsburg. M. Busch!; Jackson County, Odaville; Kanawha County, Hudnall. Large specimens up to 20.4 mm. greatest diameter. A very broad lip which is thickened internally to quite absorb the teeth in some individuals. Parietal tooth elongate. Base heavily papillose. Marion County, Smithville; Marshall County, Moundsville. This was along U. S. Route 250 not far from where state route 89 branches off for Pennsylvania. This road is along a ridge. Mason County, near Point Pleasant where U. S. Route 35 and state route 2 join; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling. Of eleven individuals two are large (18.0 and 18.3 mm. greatest diameter) while the rest are smaller with the greatest diameter ranging from 13.7 to 14.4 mm. These two large ones resemble those from Hudnall in possessing the broad lip, heavily papillated base, and the elongated parietal tooth. Both types were found together. In another lot of 34 individuals from the same locality one large one (17.3 mm. greatest diameter) was found. Unfortunately the periostracum was missing and the papillation, if it had existed, was lost. It does have the broad lip. Tyler County, Friendly. Like those from Hudnall but smaller shells (14 to 15 mm. greatest diameter).

Wood County, two miles north of Boaz. Three specimens of which one lacks the lip teeth.

Triodopsis platysayoides (Brooks). Monongalia County, Cooper's Rock State Park. Found in deep crevices and fissures in the rock. The only adult living animal taken was about 75 feet back in a cave.

Triodopsis rugosa anteridon Pilsbry. Putnam County, Buffalo.

Triodopsis fraudulenta vulgata Pilsbry. Kanawha County, Hudnall; Ohio County, Oglebay Park in Wheeling; Wood County, two miles north of Boaz.

Triodopsis notata (Deshayes). Brooke County, Williamsburg. M. Busch!; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling; Wood County, two miles north of Boaz.

Triodopsis albolabris (Say). Harrison County, Wolf Summit; Kanawha County, Hudnall; Mason County, near Point Pleasant; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling.

Triodopsis dentifera (Binney). Monongalia County, Cooper's Rock State Park.

Allogona profunda (Say). Kanawha County, Hudnall; Marion County, Smithville; Ohio County, Oglebay Park in Wheeling.

Haplotrematidae

Haplotrema concavum (Say). Harrison County, Wolf Summit; Kanawha County, Hudnall; Marion County, Smithville; Mason County, near Point Pleasant; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling; Tyler County, Friendly; Wood County, two miles north of Boaz.

Zonitidae

Euconulus fulvus (Müller). Kanawha County, Hudnall.

Retinella sp. Monongalia County, Cooper's Rock State Park. Two immature shells of about 2¾ whorls. Presumably in the subgenus *Nesovitrea* (=*Perpolita*) as there are no major series of incised radiating lines. Spiral sculpturing is quite distinct at a magnification of 27 diameters. Marion County, Smithville. Three immature shells of 2 to 3 whorls possessing incised radiating sculpture. Possibly *R. indentata* (Say).

Retinella virginica Morrison. Kanawha County, Hudnall. The largest of the two shells has four whorls and a major diameter of 2.8 mm.

Retinella indentata (Say). Wood County, two miles north of Boaz.

Retinella carolinensis (Cockerell). Kanawha County, Hudnall.

Mesomphix inornatus (Say). Cabell County, Milton; Kanawha County, Hudnall; Marion County, Smithville; Mason County, near Point Pleasant; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling; Wood County, two miles north of Boaz.

Mesomphix vulgatus (H. B. Baker). Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling.

Mesomphix cupreus (Rafinesque). Kanawha County, Hudnall; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling.

Paravitrea multidentata (Binney). Kanawha County, Hudnall; Ohio County, Oglebay Park in Wheeling.

Paravitrea reesei Morrison. Kanawha County, Hudnall.

Paravitrea capsella (Gould). Kanawha County, Hudnall. Toothed young predominate with the teeth persisting in some apparently adult shells. One immature shell of 4¼ whorls has three teeth.

Hawaiia minuscula (Binney). Kanawha County, Hudnall; Monongalia County, Cooper's Rock State Park.

Gastrodonta fonticula new species. Pl. 6, fig. 3.

Shell distinctly umbilicate with the umbilicus contained about eight times in the greatest diameter of the shell. The umbilicus scarcely narrowing to the apex of the shell. Inner edge of last ¾ (usually) of the body whorl forming a ridge round the opening of the umbilicus. The base of the body whorl is strongly convex; the greatest convexity about midway between the umbilicus and the periphery. Between this and the umbilicus the surface is slightly concave and ribbed. This concave surface has the appearance of a broad, shallow groove surrounding the umbilicus. The inner edge forms a narrowly rounded ridge around the umbilicus. Shell of 7.9 whorls (type specimen). In apical view the shell is not separable from *G. interna* (Say). The sculpturing is identical in the two species. The spire is

dome-shaped, but not as high as in *G. interna*. Index of h/d = 59% for the type specimen. Aperture as in *G. interna*. Two teeth appearing within the aperture as very short lamellae about as long as high. The teeth are nearly the same size although the outer one shows a tendency toward a greater height and width. (In *G. interna* the outer tooth is appreciably bulkier than the inner tooth.) Soft parts of the animal unknown.

Height 3.7 mm., greatest diameter 6.3 mm.; 7.9 whorls. Type.
Height 3.2 mm., greatest diameter 5.8 mm.; ? whorls. (Apex broken.)
Height 3.2 mm., greatest diameter 6.0 mm.; 7.5 whorls.
Height 3.0 mm., greatest diameter 6.1 mm.; 7.8 whorls.
Height 3.6 mm., greatest diameter 5.7 mm.; 7.5 whorls.
Height 3.5 mm., greatest diameter 5.7 mm.; 7.1 whorls.
Height 3.5 mm., greatest diameter 6.9 mm.; 7.3 whorls. This individual, with a much lower spire, presents a peculiarity of the teeth. The inner one is wider than high with the sides sloping toward the callous base. The outer one consists of three bluntly pyramidal tubercles rising from the callous base. The bases of these tubercles are confluent, and the tubercles themselves are irregularly placed. They are arranged along an anterior-posterior line with the middle one offset slightly toward the inner tooth.
Height 3.6 mm., greatest diameter 6.0 mm.; 7.7 whorls.
Height 3.7 mm., greatest diameter 5.9 mm.; 7.5 whorls.
(These last two paratypes are in my own collection.)

Type locality: On steeply sloping, wooded hillside on the east side of Paint Creek, Hudnall, Kanawha County, W. Va. Collected in June of two successive years (1937 and 1938).

Type and paratypes are in the Academy collection (No. 183479) with two paratypes in my own collection.

The specific name is derived from the Latin *fonticulus,* meaning a little well, and refers to the umbilical character.

The most significant feature of this shell is the well-like umbilicus permitting an uninterrupted view to the apex. It is this character which most readily allows its separation from *Gastrodonta interna* (Say). Of this latter species Say (Proc. Acad. Nat. Sci. Phila., 2, Pt. 1: 155, 1821) says, "Umbilicus obsolete or wanting." A. Binney (Terr. Moll., 2: 247, 1851) says, "The umbilicus is nearly, or quite obsolete." Pilsbry (Land. Moll. N. Amer., 2 (1): 429, 1946) says, "The shell is minutely perforate." *Gastrodonta interna* is most constant in this spe-

cific characteristic. In all its characters it is probably more constant than any other North American zonitid shell. *G. fonticula* is decidedly distinct. No *Gastrodonta interna* were collected at the locality of *G. fonticula,* but further collecting is most desirable.

Plate 6, fig. 3, umbilical, apical and facial views of the type specimen. For comparative purposes, and because the species has never been illustrated photographically, I have added the umbilical and facial views (fig. 4), of *Gastrodonta interna* (Say). The specimens of *G. interna* are A.N.S.P. No. 68668; collected by S. N. Rhoads in 1895 at Sawyer's Spring (elev. 1300 ft.), Walden's Ridge, Hamilton County, Tennessee.

Ventridens collisella (Pilsbry). Kanawha County, Hudnall.

Ventridens ligera (Say). Brooke County, Bethany; Cabell County, Milton; Harrison County, Wolf Summit; Kanawha County, Hudnall; Marion County, Smithville; Marshall County, Moundsville; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling; Pleasants County, St. Mary's. Along route 21 about one half mile below St. Mary's. Tyler County, Friendly; Wetzel County, New Martinsville.

Ventridens intertextus (Binney). Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling.

Zonitoides arboreus (Say). Brooke County, Bethany; Mason County, near Point Pleasant; Ohio County, Oglebay Park in Wheeling; Tyler County, Friendly; Wayne County, Ceredo. At the edge of the golf course. Wood County, two miles north of Boaz.

Endodontidae

Anguispira alternata (Say). Brooke County, Bethany. Also from Williamsburg. M. Busch!; Kanawha County, Hudnall; Marion County, Smithville; Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling. The carinate form was also found here. Wood County, two miles north of Boaz.

Anguispira kochi (Pfeiffer). Brooke County, Bethany; Ohio County, Oglebay Park in Wheeling.

Discus cronkhitei anthonyi (Pilsbry). Wayne County, Ceredo.

Discus patulus (Deshayes). Brooke County, Bethany. Also from Williamsburg. M. Busch!; Kanawha County, Hudnall; Marion County, Smithville; Ohio County, Oglebay Park in Wheeling; Wood County, two miles north of Boaz.

Helicodiscus parallelus (Say). Kanawha County, Hudnall. Two distinct varices demarcated on each of the two adult shells. One individual has the internal pair of teeth just inside the aperture. In the other individual they are just posterior to the posterior varix. Tyler County, Friendly.

Succineidae

Succinea ovalis (Say). Nicholas County, Little Elk Mountain. Elevation of peak is 1448 feet.

Succinea avara (Say). Brooke County, Bethany; Monongalia County, Cooper's Rock State Park.

Cochlicopidae

Cochlicopa lubrica (Müller). Kanawha County, Hudnall. These individuals are somewhat narrower than is typical for the species.

Pupillidae

Gastrocopta armifera (Say). Monongalia County, Cooper's Rock State Park; Ohio County, Oglebay Park in Wheeling.

Gastrocopta contracta (Say). Kanawha County, Hudnall; Ohio County, Oglebay Park in Wheeling.

Gastrocopta pentodon (Say). Kanawha County, Hudnall.

Strobilopsidae

Strobilops aenea Pilsbry. Kanawha County, Hudnall.

No attempt has been made here to indicate which records are indicative of an extended range. Nor have I made any effort to designate records that are new to the literature on the subject. There is so little actually known from West Virginia that almost any faunal list will incorporate new distributional records. My own collections, as delineated above, undoubtedly repeat records that already exist in the literature in one or more places, but this, of course, is to be expected.

A NEW CASSIS AND OTHER MOLLUSKS FROM THE CHIPOLA FORMATION [1]

By JOHN DYAS PARKER

Ten Mile Creek, Calhoun County, Florida, has been a Mecca for shell enthusiasts since 1889, when Frank Burns, a veteran field man of the U. S. Geological Survey, sent in material from the Creek bank, "1 mile west of Bailey's Ferry" across the Chipola River, and from "McClelland farm," on the bank of the Chipola, 1 mile below the ferry. The rich fauna was determined and described by William H. Dall in the Transactions of the Wagner Free Institute of Science, Philadelphia. Paleontologists have made many pilgrimages to these outcrops and few fossil localities in Florida have been more frequently visited.

"Bailey's Ferry" has long since been abandoned and replaced by a highway bridge. Cooke [2] located the outcrop "at or near the crossing of the present state highway 84 (from Marianna to Clarksville) 4.7 miles north of Clarksville, on the line between sections 11 and 12, T. 1 N., R.10 W." In 1914, Cooke found at that locality a 12 foot exposure of fossiliferous calcareous sand; the lower part bluish gray to yellowish and containing beautifully preserved marine shells; the upper part a light gray to white micaceous, argillaceous sand similar to that in a corresponding relationship at Alum Bluff.

On April 18, 1946, Mr. Charles Locklin and I found the deposit on the north bank of Ten Mile Creek about thirty feet east of the present highway bridge of Florida No. 84. The richest fauna, including a new *Cassis,* was found along a six inch band of bluish clay which was of a different color and more arenaceous texture than the "maple sugar" brown clay above and below it. The molluscan fauna was so prolific here and of such a character that we recalled Dall's interpretation of the Chipola fauna:

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[1] The name "Chipola formation" was first used "by right of discovery" in the unpublished field notes of Frank Burns, 1889, for the "Miocene of West Florida."

[2] Cooke, C. Wythe, Geology of Florida, Florida Dept. Conserv., Geol. Bull. 29, p. 163, 1945.

"The deposit is one which must have been formed under very favorable conditions of food supply and in a depth of water greater than that which occurs within the limits of the tides."[3]

The following shells were found in the Chipola outcrop at this point on this visit.

CASSIS DELTA new species. Plate 6, figs. 1, 1a, 1b.

Adult shell solid, inflated dorsally, the outline of the apertural face triangular. Surface glaze worn through over much of the shell but persisting on the callus and the flattened outer lip. Seven whorls, not including the missing nuclear and possibly the earlier postnuclear whorls. Upper surface sculptured with axial wrinkles about as wide as their intervals, disappearing at the shoulder of the whorls, which bear a series of solid flattened, unequal peripheral tubercules; the conspicuous dorsal one is somewhat abraded in the holotype. Two lesser, obscure bands of nodules, about ten mm. wide, run parallel to the carina, on the midpart of the body-whorl, dividing it into three subequal parts; anteriorly there are about five obscure spiral cords adjacent to the anterior canal. The suture is unusually irregular, following at certain stages the periphery of the preceding whorl, and at other stages, even on the apical whorls, it is pushed back of the periphery. The spire is short, low, with a wide apical angle. The aperture is narrow. Outer lip much thickened along its entire length by the terminal varix, and produced posteriorly, bearing, along its inner surface, a series of eight ridges equidistant from one another. The inner lip bears ten long, narrow teeth of which six run to the inner margin, as well as two denticles at the posterior notch, and flares to form part of the apertural shield. This shield is so alate as to form an equilateral triangle when both lips of the aperture are considered. This hatchet-shaped alation is so produced that it hides the entire body whorl when the shell is viewed from a ventral aspect. The penultimate varix has its outer margin extended to the lip of the alation of the terminal varix where the two varices are fused together. The alation is much thickened at its posterior end and fills the area between the shield and the previous varix. This shelly material covers the shoulder of the previous whorl. In an apical view the shell has a triangular outline. The posterior extremity of the aperture is obscurely notched. The anterior channel is deep, tortuous, and forms a

[3] Dall, William Healy, and Stanley-Brown, Joseph, Cenozoic Geology along the Apalachicola River, Geol. Soc. Amer. Bull., vol. 5, p. 165, 1894.

pronounced recurved canal similar to that of *Cassis tuberosa* L. The columella is twisted at its lower end and bent back on itself at the point where it joins the anterior canal. There is both a false and a true umbilicus, the latter being only a slight chink. Periostracum and operculum unknown.

Juvenile shell (Pl. 6, figs. 2, 2a, 2b) cassidiform, differs from adult in the parietal face. Outer lip not as thick as in adult, has convex outer lip; slight sulcus at posterior end. Anterior canal as in adult. 12 teeth and denticles similar to adult. Shield glossy, calloused, extending to penultimate varix, sculpture seen through enamel, lacks hatchet-shaped alation of adult. Outer lip has 9 tuberculations almost equidistant along its inner surface. Upper whorls badly worn, about 40 faint axial striations on the protoconch. Second and third whorls lack sculpture of any kind. Third whorl more globose. Fourth whorl has faint spiral sculpture, channeled suture bears tiny granules Sixth whorl, with normal sculpture, has the first varix 90° past the aperture.

Height 138 mm., greatest diameter 97 mm., height of apertural shield 135 mm., greatest width 140 mm. Holotype.

Length 134 mm., least diameter 99 mm., greatest diameter 101 mm.

Length 44.7 mm., least diameter 32.7 mm., greatest diameter 34.8 mm.

Length 41.2 mm., least diameter 27.5 mm., greatest diameter 28.0 mm.

Types: Holotype and smallest paratype U.S.N.M. No. 543482. Two paratypes A.N.S.P. No. 18680.

Type locality: The bank of Ten Mile Creek on the east side of the bridge of Florida highway No. 84, 4.7 miles north of Clarksville, Calhoun Co., Florida, Chipola formation.

Remarks. Two adult and two juveniles were found. The unbroken adult is very mature and younger shells might not possess the heavy callosity described in this paper. This species is very close to *Cassis sulcifer* Sby. of the Cercado and Gurabo formations of Santo Domingo and the Gatun formation of Costa Rica. *Cassis delta* is much larger than any *C. sulcifer* recorded. The inner lip of *C. sulcifer* has 16 well developed lirae while *C. delta* has only 10 feeble teeth and 2 denticles. On the outer lip *C. sulcifer* has 10 well developed teeth running laterally across the ventral surface of the shield. *C. delta* has eight ridges in the adult, which do not extend to the exterior of the

shield. Compared with *C. tuberosa* L. we find that the shield is quite different. In *C. tuberosa* the alation is quite attenuated while in *C. delta* it is ample. The teeth on the outer margin of *C. tuberosa* are well developed, extending well across the margin, and on the lower lip are long, tapering, and numerous, while in *C. delta* the corresponding ridges are more feeble. On the outer lip they extend only a short way across the enameled surface while on the inner lip they number only half those of *C. tuberosa*. The axial wrinkles of tuberosa are much finer and less prominent, and irregular spirals cover most of the apical surface. *C. delta* does not resemble *C. flammea* L. as closely as it does *C. sulcifer* or *C. tuberosa*, the most outstanding difference being the shape of the apertural shield. *C. flammea* has an ovate shield while that of *C. delta* is triangular to hatchet-shaped. When set on its apex *C. flammea* leans to the left and the holotype of *C. delta* sits upright.

Associated with the Cassis were the following determined by Dr. Julia Gardner:

Calliostoma ceramicum Dall
Smaragdia chipolana (Dall)
Tricolia affinis chipolana Gardner
Tricolis probrevis Gardner
Rissoina (Cibdizebina) browniana d'Orb.
Turritella alcida bicarinata Gardner
Turritella subgrundifera Dall
Turritella (Torcula) dalli Gardner
Turritella (Torcula?) mixta Dall
Lemintina cf. L.? granifera (Say)
Caecum sp. ind.
Alaba chipolana Dall
Bittium permutabile Dall?
Bittium chipolanum burnsii Dall
Bittium cossmanni Dall
"Cerithium" chipolanum Dall
Triphora sp.
Strombiformis scotti (Maury)
Strombiformis sp.
Pyramidellidae, several genera and species.
Calyptraea centralis (Conrad)
Crepidula sp.
Xenophora textilina Dall
Natica (Natica) alticallosa Dall
Polinices? demicryptus Gardner
Polinices (Neverita) chipolanus Dall
Sinum chipolanum Dall
Globularia fischeri (Dall)
Ficus eopapyratia Gardner
Murex chipolanus Dall
Murex dasus Gardner
Murex (Chicoreus) folidodes Gardner
Paziella (Dallimurex) lychnia Gardner
Typhis linguiferus Dall
Eupleura caudata (Say)

Mitrella oryzoides Gardner
Mitrella blastos Gardner
Mitrella sp.
Mitrella ischna mitrodita Gardner
Strombina aldrichi (Maury)
Engoniophos glyptus Gardner
Busycon sicyoides Gardner
Busycon sp.
Hesperisternia chipolana Gardner
Uzita cinclis Gardner
Uzita harrisi (Maury)
Olivella oryzoides Gardner
Vexillum (Uromitra) cnestum Gardner
Mitra (Tiara) mitrodita Gardner
Mitra (Pleioptygma) prodroma Gardner
Kurtziella websteri Maury
Nannodiella near N. nemorensis (Maury)
Microdrillia hebetika Gardner
Conus chipolanus Dall
Terebra (Paraterebra) odopoia Gardner
Terebra (Strioterebrum) langdoni perpunctata Dall
Acteon fusulus Dall
Acteon sp.
Ringicula semilimata Dall
Bulla striata Bruguière?
Atys oedemata Dall
Atys (Roxaniella) gracilis Dall
Haminea pompholyx Dall
Abderospira chipolana Dall
Sulcularia chipolana (Dall)
Sulcularia prosculcata Gardner
Volvula oxytata Bush, s. l.
Acteocina incisula Dall
Acteocina incisula curtoides Gardner
Cylichna decapitata (Dall)
Vaginella chipolana Dall
Nucula chipolana Dall
Sacella proteracuta Gardner, s. l.
Sacella cf. S. proteracuta dystakta (Gardner)
Sacella proteracuta diamesa (Gardner)
Sacella proteracuta leita (Gardner)
Sacella leptalea (Gardner)
Sacella cf. S. diphya (Gardner)
Yoldia frater Dall
Trinacria meekei parameekei Gardner?
Arca cf. A. umbonata Lamarck
Anadara hypomela (Dall)
Anadara (Cunearca) initiator (Dall)
Pleurodon cf. P. woodii Dall
Crenella minuscula Dall
Pecten (Pecten) burnsii Dall
Chlamys chipolana (Dall)
Chlamys (Lyropecten) condylomatus (Dall)
Amusium cf. A. precursor Dall
Anomia micrographmata Dall
Anomia cf. A. micrographmata Dall
Ostrea sp. ind.
Verticordia (Trigonulina) dalli Gardner
Crassatellites (Scambula) chipolanus Dall
Crassatellites (Crassinella) triangulatus Dall
Glans (Pleuromeris) cf. G. (P.) tellia (Dall)
Glans (Pleuromeris) tellia Dall
Sportella leura Gardner
Sportella sp.
Diplodonta (Phlyctiderma) glos Gardner
Phacoides (Parvilucina) sphaeriola Dall

Phacoides (Parvilucina) sphaeriola angalea Gardner
Phacoides (Bellucina) euphea Gardner
Phacoides (Parvilucina) sp.
Lucinisca calhounensis Dall
Plastomiltha heilprini Gardner
Divaricella chipolana Dall
Codakia (Jagonia) erosa Dall
Eryeina undosa Dall?
Alveinus rotundus Dall
Chama draconis Dall
Fragum burnsii Dall
Laevicardium compressum Dall
Tellina (Eurytellina) pressa Dall
Tellina (Moerella) cloneta Dall
Tellina (Moerella) acosmita Dall
Macoma (Psammacoma) marmorea Gardner
Donax chipolanus Dall
Donax chipolanus curtulus Dall
Semele chipolana Dall
Semele stearnsii Dall
Semelina cytheroidea Dall
Mulinia cf. M. sapotilla Dall
Ervilia chipolana Dall
Gafrarium (Gouldia) erosum bolteni Gardner
Callocardia (Agriopoma) sincera Dall
Transenella sp.?
Pitaria floridana Dall
Macrocallista maculata Linne? juv.
Dosinia (Dosinidia) chipolana Dall
Chione chipolana Dall
Chione (Lirophora) burnsii Dall
Spheniopsis americana Dall
Zirfaea sp.
Corbula chipolana (Dall MS.) Gardner
Dentalium (Antalis) chipolanum Gardner
Cadulus (Polyschides) lobion Gardner
Cadulus (Gadila?) volvulus Gardner

ACHATINA ACHATINA (L.) LAYS ITS EGGS

By E. A. ANDREWS

One of the big African agate snails, *Achatina,* kept some six weeks in a packing box with earth and sphagnum moss in Baltimore, Md. laid eggs. It was fed with lettuce and watermelon. In dry weather it remained quiet night and day with its wide foot-sole folded under it in wedge form, but in moist weather it crawled about, preferably at night time. When made wet the foot would spread out as the head came forth and then it would crawl upon glass or upon one's hand and would not fall off when upside down, unless it had secreted too much slime.

Arrived at an edge it might fall off, but was not injured by eighteen inches drop.

August seventh, in gentle rain, it escaped and late at night had made a straight course of some yards under cane brake, leaving a trail along the ground like that of a field mouse. Returned to its box it was found the next morning standing over a depression in the sphagnum in which were three fine yellow eggs. Its body stood neatly over the eggs as if it had dropped them into the depression as the garden snail drops its eggs into a hole that it has made in the earth. At two p.m. there were at least six eggs under the snail, in two rows. The following morning the eggs were as many as twenty and were still partly covered by the snail; but that afternoon it had left the whole batch of twenty-two eggs and did not chance to crawl near that region again for four days. Meantime the eggs were removed and kept moist and warm in sphagnum.

August twelfth an egg weighed 330 milligrams and was nine millimeters in length and eight and seven and a half in diameters. Though longer than wide it had nearly equal curvatures at each end and two of its faces were slightly flattened. The hard shell was yellow but covered with a sticky layer of more orange hue that was easily rubbed off.

September second some of the eggs were cracked open as if ready to hatch but all the embryos were dead. One embryo measured six mm. and another that filled the shell measured ten mm. Already the embryo shell had three whorls and on its transparent shell there were three meridional bands of chestnut-red color.

Many active nemas swarmed on the outside of the egg shells and death of the embryos may have come from too much moisture and inadequate oxygen supply.

It is reported that some omnivorous Achatina laid as many as two hundred eggs in a snailery. As they eat waste vegetable food and lay in captivity it seems possible that in a favorable climate, say south Florida, they might be developed as an addition to our sources of animal food.

Nov. 6, 1947.

COMPARATIVE OBSERVATIONS ON THE MATING OF CERTAIN TRIODOPSINAE

By GLENN R. WEBB

While the differences in the sex-organs form a major item in determining the relationships among the Polygyrid snails, no comparative studies appear yet to have been made on the functioning sex-organs so far as I am aware. The present studies are from observations on the matings of captive specimens, and from the anatomies obtained from specimens killed in coitus. It was found necessary to kill the animals with boiling water despite the attendant shrinkage or other distortion which might affect the anatomies.

The accompanying figures are from free-hand drawings and are subject to minor errors of proportion; the figure-scales represent about the equivalent of 1 mm.

The writer is indebted to Dr. Frank C. Baker for casual citations to helpful references, and to Mr. Tucker Abbott for aiding in the search. The responsibility for the reference material, however, rests with the author, and is as complete as his available bibliographic sources allow.

Triodopsis tridentata (Say), Fig. 4. The mating procedure of this species is typical of three of the four species of Triodopsinae I have examined.

The courtship consists of the following actions: The slow approach of one or both animals so that they come to lie facing each other; and then of a reorientation which brings the genital pores into apposition and the everted sex organs in contact.

The tentacles play an important part in the reorientation. For as the animals draw closer and closer together, the tentacles are progressively shortened and restricted in movement, being especially attracted to the site of the genital pore and the everting or already everted sex organs. To "focus" the right inferior tentacle over the mate-animal's organ, the animal must move forward diagonally. As this action is completed by both animals, their everting sex organs are touched together and shifted so that they are contiguous and evenly apposed. Coitus follows immediately.

The insertion of the penis into the female organ is not externally observable, but is indicated by an accompanying slight movement of the animals' head regions. Superficially, the engaged sex-organs appear externally as a single, short, whitish, cylindroid body about 2 mm. long and of equal diameter. Closer inspection reveals the median, transverse groove which delimits, externally, the organs of each animal. An even slighter groove indicates the component male and female parts; thus, in reality, four distinct organs are visible.

Coitus lasts about five to fifteen minutes in this species and the next. The specimens usually gnaw at the adjacent part of their mates' everted sex organs during part or all of the coition period. This action is comparable to the dart-sticking actions of certain of the dart-bearing landsnails when mating, and may serve a homologous purpose. The copulation is either reciprocal, with a mutual exchange of semen, or it is one-sided, one animal acting as the male and the other as the female (see fig. 4).

The mating anatomies reveal the following details: The female organ protrudes as a low, cylindrical swelling with a circular terminal orifice that is penetrated by the inserted penis of the mate-animal.

The penis is club-shaped, bearing apically an oval body (PB, f. 4) pendant on a more elongate, tubular stalk (PS). The apical body is laterally compressed and bears a series of crescentic, papillate ridges (PR) which converge to the site of the ejaculatory pore. A blunt tubercle (PT) projects from the margin of the club, and the ejaculatory pore [1] is situated on the ventro-basal part of this tubercle.

Triodopsis notata (Desh.), Fig. 1–1a. The courtship of this species is similar to that of *tridentata*.

The engaged sex organs caricature rather than simulate their appearance in that form, chiefly due to the greater protrusion of the female organ and the to be expected greater size of the organs generally. (See fig. 1.)

The mating anatomies reveal the following details: The female organ (FO) is a tumid, barrel-shaped body with a circular,

[1] The external orifice of the penis through which the male sex-products are discharged.

terminal orifice that is penetrated by the associate animal's penis (P, f. 1). The inner wall of the female organ is formed by the expanded basal portion of the spermathecal duct (BSD). The oviduct (O) appears to be passively carried downward by the descent of the former; however, the inserted penis occupies only the cavity formed by the expanded spermathecal duct. The outer wall of the female organ appears to be formed, in part at least, by the vagina.

The penis is stout, cylindric, and blunt-tipped; the variable number of folds and ridges which occupy its upper part seem to be retraction disconfigurations (RD). A longitudinal series of low, obscurely nodulose ridges (PR, f. 1a) converge to the site of the ejaculatory pore situated near the tip of the penis. There appears to be no tubercle marking this place.

Triodopsis multilineata (Say), Fig. 2–2a. The courtship is also similar to that of *tridentata*. The engaged sex organs, however, do not appear as in that species; since the female organ is not everted, and the genital pore is encircled by a slight, fleshy ridge and is much dilated.

Coitus has been observed to last as long as nine hours. A pair of abnormally situated specimens (which clung to the vertical wall of a crowded corner of their cage) were seen to mate for about one hour, the shortest coitus I have observed with this species. I cannot recall having seen this form gnaw at the everted sex organs. Animals separated in coitus (which takes a surprisingly vigorous pull) have difficulty in retracting the everted penis. This may explain why no difficulty was experienced in obtaining anatomies with fully everted sex organs. In contrast, mating anatomies of *tridentata* and *notata* were difficult to secure.

The mating anatomies reveal the following details: The vagina [2] (V) seems to occupy the same position as in non-mating animals; it functions as the female organ and consequently receives the deeply inserted penis of its mate. This is very different from the arrangement in *T. notata*, since in that form the expanded spermathecal duct receives the inserted penis.

[2] and lower oviduct?

The penis is long, papillate, and tubular, tapering from a short (2 mm.), smooth, basal stalk (PS) into the longer (13 mm.), wider, papillate part which forms the bulk of the organ (PB). The papillae are arranged in rows. The papillate part bears a longitudinal groove[3] (PG) and a peculiar auxiliary process, which resembles a minute "fish-tail" in shape, that arises from a special locus behind the blunt tip of the penis, and has the appearance of having been from that organ. The ejaculatory pore is situated on a low swelling between the "tail-lobes" of the auxiliary process (AP. f. 2a). In natural position, the auxiliary process lies parallel to the body of the penis and may be partly imbedded in a mass of congealed semen which usually occupies the intervening space. The ejaculatory pore opens toward this space.

ALLOGONA PROFUNDA (Say), Fig. 3–3a. This species departs most from the *tridentata* type mating habits.

Courting commences as in that form, but starting with the eversion of the sex organs, the structures and actions are only remotely similar. The genital organs commence everting as soon as the animals contact each other. First the genital pore dilates and a low swelling appears, then a collar-like body materializes with a low cone-shaped central swelling which continues to be protruded[4] and to assume a tape-like shape. This central body is the so-called "stimulator." The completion of the protrusion of the sex organs depends on the subsequent behavior of the animals.

The courtship (which has been proceeding as in *tridentata*) is now modified by the inception of biting duels. These arise when one animal reaches forward, protrudes the jaw and radula as much as possible, and bites its mate on the head. The bitten animal cringes back and may continue turning away from the aggressive animal, rotating so that it reassumes its former position, or it may merely move its foreparts to one side and launch a counter-attack. I have never seen a drawn battle de-

[3] which in some specimens appears as a wide, shallow, non-papillate, longitudinal channel or stripe.

[4] The "stimulator" seems to be protruded rather than everted; the penis body seems, however, to be everted.

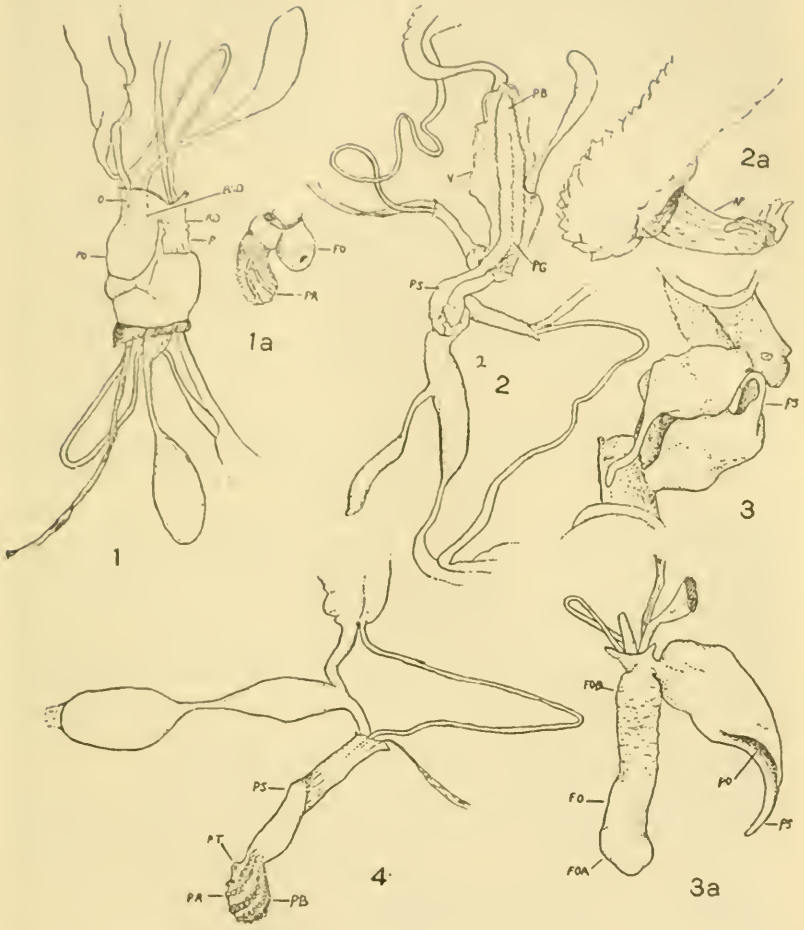

FIG. 1. *Triodopsis notata* (Desh.), mating position (from undisturbed mating anatomies); 1a, everted sex organs. FIG. 2. *Triodopsis multilineata* (Say), mating anatomies (vagina opened in upper specimen showing inserted penis); 2a, greatly enlarged lateral view of tip of penis showing auxiliary process. FIG. 3. *Allogona profunda* (Say), in coitus; 3a, separated mating anatomy. FIG. 4. *Triodopsis tridentata* (Say), mating anatomy of acting male in a non-reciprocal copulation.

velop, since the first animal to be bitten withdraws immediately. While one of the animals pivots, the other may also pivot; crawl slowly forward, with upraised head and absent-mindedly munching jaws (a ludicrous sight indeed!); or it may remain stationary, playing its tentacles about questioningly for its mate. The effect of these highly stimulatory actions is to cause an increased protrusion of the sex organs, of which only the penis is at first identifiable. As soon as the protruded penis (and possibly the at this time inconspicuous female organ) is touched against the other animal's organ, complete eversion and protrusion follows and coitus commences (see fig. 3). Simultaneously with the increased protrusion of the sex organs, the animals cease their biting and commence gnawing on these organs.

It is at this time that the probable function of the stimulator is apparent. Projecting from the apex of the penis, it is the first organ likely to encounter the animals' jaws. If this happens the stimulator continues to be gnawed at. Otherwise, the stimulator is shifted so that it rests on the head of the mate animal, which then commences to gnaw at it. No damage appears to result, as the stimulator, being unattached terminally, rises and falls inertly with the movement of the radula. Somehow it never appears to get caught in a position which would allow it to be pinched between the jaw plate and the radula. The gnawing action soon ceases however; possibly the animal considers gnawing at so elusive an organ to be futile.

Coitus lasts a long time; one pair commenced coition at 9:45 one evening and were last seen in coitus at 10:15 the next morning. Dr. Allan F. Archer (1, p. 7) reports seeing this species in coitus "for well over six hours."

The mating anatomies reveal the following details: The female organ (FO, f. 3a) is a large, tubular body and appears to be differentiated into two parts, a minutely and transversely-rugose basal part (FOB), and a smoother more tumid terminal part (FOA). The apically situated female orifice is indicated by an in-puckered depression.

The penis, which resembles a flagellate grape, is large, tumid, and ovoid. It bears apically the stimulator, an accuminate flap-like structure (PS, f. 3–3a). Below the point of the stimulator insertion, a large orifice (PO) opens into the cavernous interior

of the penis. The female organ is found resting in this cavity in undisturbed mating anatomies. The ejaculatory pore seems to be located at the tip of a small nipple-like papilla on the innermost wall of the penis cavity. There are indications that the papilla may be inserted into the orifice at the tip of the female organ during coitus.

Bibliography

(1) Archer, Allen F., 1933. "A Study of Polygyra inflecta (Say)." Occ. Papers Mus. Zool. Univ. Mich. no. 276, p. 7.
(2) Pilsbry, Henry A., 1940. "Land Mollusca of North America." Acad. Nat. Sci. Phila. Monograph no. 3, vol. 1, pt. 2.

A NEW RECORD FOR ZOÖGENETES HARPA (SAY)

By James M. Ross

During the first two weeks in August of 1946, I was collecting at scattered points throughout Michigan's Northern Peninsula, partly with the intention of publishing an annotated list of the species taken. It was hoped that such a report might be of some value, since the distribution of Northern Peninsula mollusca has not been extensively studied. However, even though the collection is comparatively small (about forty lots), there are a number of forms which I, myself, do not feel competent to identify; and this, together with the accumulation of other obligations, has postponed the proposed paper indefinitely. Meanwhile, perhaps one record is worthy of special note.

As far as I have been able to determine, there is a pronounced gap in records for the distribution of *Zoögenetes harpa* (Say). This species ranges from the Saginaw-Grand valleys to the Straits of Mackinac, but has apparently not been reported north of the Straits, except at two widely separated localities: Isle Royale, Keweenaw County; the Porcupine Mountains, Ontonagon County. The new record, near Germfask, in eastern Schoolcraft County, tends to show that the paucity of Northern Peninsula records for this species is due not to a distributional gap, but to need for additional field-work with minute forms.

The specimens were taken from the under surface of a pine board, near the north end of the M77 bridge over the Manistique River, nine-tenths of a mile south of Germfask, Schoolcraft County. This locality lies between the northern-most point of the Southern Peninsula and the other two northerly localities, about sixty miles from the former, and about 180 miles from each of the latter two.

The specimens were taken only from under the pine board, though the immediately surrounding area was searched. However, it seems likely that numerous specimens were concealed in the ground, or in the nearby grass, since specimens were taken from under the board on three separate occasions, though on each, all visible specimens were removed: one, August 5; two, August 8; two, August 12, 1946. On Isle Royale, where *Z. harpa* was collected near Siskowit Lake a week later, the species was the commonest terrestrial form observed. Here it was found under moss, on exposed bedrock surfaces.

As might be expected, the Isle Royale specimens are slightly smaller than those taken near Germfask, approximate measurements giving the following generalized sizes: Siskowit Lake, Isle Royale: altitude, 3.2 mm.; diameter, 2.5 mm.; near Germfask, Schoolcraft Co.: altitude, 3.3 mm.; diameter, 2.6 mm.

NOTES AND NEWS

Torinia canalifera "C. B. Adams" Dall.—So far as it can be traced this species was never described. It appeared as a name in Dall's list, "A Preliminary Catalogue of the Shell Bearing Marine Mollusks and Brachiopods of the South Eastern Coast of the United States" (Bulletin United States National Museum, No. 37, 1889, p. 148). C. W. Johnson listed the name in his paper, "List of the Marine Mollusca of the Atlantic Coast from Labrador to Texas" (Proc. Boston Society Nat. Hist., 40, no. 1, p. 101). This citation was from Dall's list above. It does not appear in any other standard work such as the Manual of Conchology. No specimens under this name are in the C. B. Adams Collection now in our charge. It would appear that Adams had sent out specimens under a MSS. name which he

later considered invalid and Dall included it in his list from a label rather than from a published description.—W. J. Clench.

The Genotype of Potamolithus Pilsbry.—In the Nautilus for November 1896, vol. 10, pp. 76–81, appeared a paper by Pilsbry and Rush, "List, with Notes, of Land and Freshwater Shells Collected by Dr. Wm. H. Rush in Uruguay and Argentina." On page 80 appears the generic name of *Potamolithus* associated with a list of species many of which were undescribed. A generic name is considered valid, even without a description, if one or more described species are given—as was the case here.

However, in the same publication a month later, December 1896, p. 86, the genus *Potamolithus* is described with *P. rushii* Pilsbry given as the genotype. Unfortunately, this type selection is invalid, since *P. rushii* was not one of the described species originally mentioned in connection with the introduction of the new generic name *Potamolithus*. Consequently, *Paludina lapidum* d'Orb., a well-known and well-figured species and one on the original list accompanying the name *Potamolithus*, is here selected as the genotype.—W. J. Clench.

On the term "albino."—Charles H. Blake's criticism [1] of our use of the term "albino" in an article dealing with color variation in *Olivella undatella* [2] is entirely appropriate. Through an oversight we failed to state that the soft parts of the animals in white shells were no different in coloration from those in dark shells. The so-called albinism of the shells is therefore parallel to that in *Olivella biplicata*, for which we have stated: "The animals inhabiting albino shells look like those in normally colored shells." [3]

Perhaps the use of the term "white" for the shells would be a better practice than the use of the term "albino" with its connotation of albino soft parts. Furthermore, the frequency of white *Olivella undatella* (all with normally colored soft parts) raises the question whether the whiteness of the shells is not merely one extreme of the normal color range and not an abnormality at all.—D. S. and E. W. Gifford.

[1] The Nautilus, vol. 61, pp. 32–33, 1947.

[2] The Nautilus, vol. 60, pp. 81–84, 1947.

[3] The Nautilus, vol. 55, p. 12, 1941.

NOTE ON WEST AMERICAN SPECIES OF CONDYLOCARDIA.—The genus *Condylocardia* "Munier-Chalmas (Manuscrit.)" Bernard (Bull. Mus. Nat. Hist. Nat. (Paris), vol. 2, No. 5, 1896, p. 195) was described in 1896 and the type cited the same year (Journ. de Conchyl., vol. 44, No. 3, 1896, p. 174, pl. 6, fig. 3) was "*Condylocardia Pauliana,* Munier-Chalmas" [=*Condylocardia Sancti-Pauli* "Munier-Chalmas (Manuscrit.)" Bernard, Bull. Mus. Nat. Hist. Nat. (Paris), vol. 2, No. 5, 1896, p. 196. "Ile Saint-Paul. (M. Vélain)"]. from the island of St. Paul in the southern portion of the Indian Ocean. Two species of this interesting genus have been recorded as occurring in tropical west American waters. *Condylocardia digueti* Lamy (Bull. Mus. Nat. Hist. Nat. (Paris), vol. 22, No. 8, 1916, p. 443, 3 figs. in text; Journ. de Conchyl., vol. 66, No. 4, 1922, p. 367, 3 figs. in text) was described from San Gabriel Bay, Espiritu Santo Island, Gulf of California. *Condylocardia panamensis* Olsson (Bull. Amer. Paleo., vol. 27, No. 106, December 25, 1942, p. 186 (34), pl. 16 (3), figs. 9, 10) was described from "Zone of unconformity at base of Pleistocene at Punta Piedra," Panama. Later, Pilsbry and Olsson (Nautilus, vol. 60, No. 1, July, 1946, p. 7) stated that this species occurs in the Recent west American fauna from Panama to Ecuador. Lamy's species was not mentioned by Pilsbry and Olsson and appears to have escaped the attention of most west American authors. One species referred to *Condylocardia* has been cited as occurring in the Eocene of the Paris basin, two undescribed species were cited by Pilsbry and Olsson as occurring in the Oligocene of Ecuador and two in the Miocene of Venezuela, and species have been cited as occurring in the later Tertiary in Florida, Costa Rica and New Zealand. In addition to the Recent species of this genus cited from west American waters others have been described from Florida, South Africa, New Zealand, Australia and the island of St. Paul in the southern portion of the Indian Ocean. Iredale (Rec. Australian Mus., vol. 19, No. 5, 1936, p. 272) discussed the generic assignment of some of the Australian species which previously had been referred to *Condylocardia*.—L. G. HERTLEIN AND A. M. STRONG.

Iolina, new name for Iolaea A. Adams 1860.—The name *Iolaea* Adams 1860 [1] for a subgenus of *Odostomia* seems to be preoccupied by *Iolea* Pascoe 1858 [2] and therefore a new name appears to be needed. Accordingly I would suggest the name *Iolina* which may take as type by original designation the species *Odostomia eucosmia* Dall and Bartsch 1909,[3] formerly known as *Oscilla insculpta* (Carpenter) Keep 1888,[4] which latter name is preoccupied in *Odostomia* by *Odostomia insculpta* De Kay 1843.[5]

The type of *Iolaea* was *Iole scitula* Adams, described concurrently with the genus *Iole*, a name which the author himself later changed to *Iolaea* on learning that the original form of the name was not available. But this species is not a convenient type because Adams himself used the name *scitula* on three different occasions in the Pyramidellidae and on two in the closely related family Eulimidae, according to Tryon.[6] Further, it was dredged from a depth of 63 fathoms in the Strait of Korea. It therefore seems the wiser course to designate a species from a better known region. *Odostomia* (*Iolina*) *eucosmia* ranges from San Pedro, Alta California, to Punta Abreojos, Baja California, and is sometimes found on the beach. Its advantages as genericype are obvious.—Joshua L. Baily, Jr.

PUBLICATIONS RECEIVED

Living and fossil Pupillidae (Gastropoda) of the Sanborn Area, Northwestern Kansas (Trans. Kansas Acad. Sci., 9: 407–419, 1947), by Dorothea S. Franzen. Seven species and subspecies now extinct in this area have been found in the Pleistocene deposits. Six species and subspecies of three genera are now living, but have not been found in Pleistocene. Three species are common to both. It is now a semiarid region but the

[1] Ann. Mag. Nat. Hist., 3rd. ser., v. 5, p. 300.
[2] Trans. Ent. Soc. London, ser. 2, v. 4, p. 266.
[3] Bull. U. S. N. M. 68, p. 183.
[4] West Coast Shells, p. 52.
[5] Zool. N. Y., pt. 5, p. 115, pl. 31, f. 297.
[6] Man. Conch., v. 8, p. 403, 1886.

snail fauna indicates that the climate in Pleistocene times was cooler and more humid. The species are well illustrated on two plates. The occurrence of *Pupoides hordaceus* (Gabb) is rather remarkable, as *P. inornatus* (Van.) would be expected in that area.—H. A. P.

Observations on the biology of the snail Lymnaea stagnalis appressa during 20 generations in laboratory culture (Amer. Midland Naturalist, 36: 467–493), by Lowell E. Noland and Melbourne R. Carriker. (1) A simple inexpensive method is described for culturing *L. s. appressa* in large numbers in relatively small space through an indefinite number of generations. This method involves rearing the snails in three to ten liters of aerated water in deep covered glass jars located in subdued natural light, with approximately two adult snails to each liter of water. The water used is deep well water rich in calcium and magnesium, and alkaline reaction. The jars are cleaned and the water changed weekly, or bimonthly at the longest, and in winter the cold water is warmed to the prior temperature of the aquarium before the snails are placed in it. A small quantity of fine sand, used in trituration of food by the snail gizzard, is furnished in the aquaria. Loose green head lettuce leaves are kept available in the aquaria most of the time; and weekly, wheat cereal cooked in milk and supplemented by a mixture of balanced salts is added. (2) Prehatching mortality by this method is negligible. Sexual maturity is reached in about three months and the average final length of snails reached is between fifty and fifty-five mm. The longest snail ever cultured attained a length of 62.5 mm. The maximum life span of the snail under these cultural conditions is fourteen months. (3) Observations on crawling and feeding, movements concerned with respiration, overcrowding, copulation, oviposition and egg production, gross embryology, hatching, exchange of water for air in the lung, desiccation, etc., are recorded. (4) Egg production was approximately doubled by the addition of cooked wheat cereal to the normal lettuce diet.

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NEW VEXILLUM AND AESOPUS FROM THE PLIOCENE OF ST. PETERSBURG, FLORIDA

By WILLIAM G. FARGO

A small Pliocene marl deposit in the north part of the City of St. Petersburg, Florida lies with its northern end about 150 feet east of Ninth Street, and runs thence southeasterly from Seventieth Avenue north, about 500 feet. This bar or reef here reaches the surface which is only five to seven feet above mean tide. It is about three miles westerly from Tampa Bay. The reef is fifty feet wide or less and only about three or four feet in depth. It is overlain in part and surrounded by Pleistocene sands. Both deposits contain quantities of their respective characteristic mollusean remains, a majority in good state of preservation. The perfect condition of many small and fragile shells indicates that they have not been carried far by currents.

Since this Pliocene deposit was discovered by A. P. Cales in 1938 it has been thoroughly prospected. A majority of the shells duplicates the Caloosahatchee material some 100 miles to the south, but because of the intensive screening at North St. Petersburg the total of the molluscan species evidently outnumbers the list of 639 species from the Caloosahatchee Valley as compiled by Dall.[1]

In 1943, the pyramidellid species from this Pliocene reef as well as those from the Pleistocene road material pit, five miles southeast of Largo, Florida, were sent to Dr. Paul Bartsch who is preparing a report on that family. The remainder of the Fargo-Locklin collections have been deposited, for the most part, with the Academy of Natural Sciences in Philadelphia, Here, Dr. Henry A. Pilsbry, Anne Harbison and R. A. McLean have

[1] Trans. Wagner Free Inst. Sci., v. 3, 1890–1903; pp. 1603–1614.

been engaged on a comprehensive report. Earlier and at different times, Dr. Julia A. Gardner of the U. S. Geological Survey, Dr. Paul Bartsch and Dr. Harald A. Rehder of the U. S. National Museum have rendered valuable assistance in identifications.

The purpose of the present paper is to list the species of genus *Vexillum* from the St. Petersburg Pliocene, to describe a new species of that genus, also a new *Aesopus* from that deposit. Mitrid species referable to *Vexillum* ("Bolten") Roeding are not uncommon here, the following being represented:

Vexillum (*Costellaria*) *cryptidulum* Woodring 1928.
Vexillum (*Uromitra*) cf. *syntomum* Woodring 1928.
Vexillum (*Uromitra*) *wandoensis* (Holmes) 1860, pl. 7, fig. 3.
Vexillum (*Uromitra*) *holmesii* (Dall) 1890, pl. 7, figs. 1, 2.
Vexillum (*Uromitra*) *healeyi* new species.
Vexillum (*Uromitra*) *willcoxi* (Dall) 1890, pl. 7, figs. 9, 10.

Of these, *V. holmesii* and *V. willcoxi* are the most numerous with *V. healeyi* next in abundance. The other three listed are rare. With the exception of *V. wandoensis*, none of these species seems to have been reported as recent.

VEXILLUM (UROMITRA) HEALEYI, **new species.** (Plate 7, figures 4 to 8.)

Shell small, slender, the spire slightly inflated, or not inflated, the basal aspect somewhat pupoid, whorls cylindric, turreted; considerable variation in form, sculpture rather constant. Protoconch of about two volutions, blunt at apex, rapidly enlarging, smooth with obscure axials toward the end of the last turn indicating the beginning of the conch which normally consists of about six whorls. The dominant sculpure is axial, 16 to 18 ribs extending from suture to suture, enlarged or "headed" at the posterior end and commonly arcuate (concave forward). The ribs close-set on the early whorls. Later whorls have intercostal spaces equal to that of the ribs. The spiral sculpture consists of close-set flattened cords, five or six to the whorl, somewhat obscure, hardly overriding the ribs. Behind the suture is a narrow channeled groove cutting through the ribs and interspaces, with sometimes two such on the body. This "double suture" appearance and the slender form and cylindric whorls

are the characters separating this species from *V. willcoxi* which it otherwise somewhat resembles.

Aperture about four-tenths the total length, contracted at summit, hardly narrowed at the base, so that the canal is not much indicated; its base slightly emarginate; the pillar sharply contracted, outer lip thin, lirate within (seven lirae, well inside, on the type); three strong folds on the columella, the posterior two of about equal strength and becoming nearly horizontal, quite pearly. Below the periphery on the body whorl of adults, the spirals become wide or nodulous bands, overriding the ribs which become attenuate and closely spaced, extending to the canal base, or nearly so.

Measurements: The holotype (figs. 7, 8), length, 8.6 mm., length of last whorl, 4.3 mm., length of aperture, 3.4 mm., diameter, 2.8 mm. Whorls; protoconch, 2, of the conch 6.3. Type A.N.S.P. 18340.

It is evident that *Vexillum healeyi* represents the species referred to by William Healey Dall (Trans. Wagner Free Inst. Sci., v. 3, p. 93). "*Mitra* Sp. Indet." "A single specimen too worn to name was found in the Caloosahatchie marl. It has about 16 ribs . . . just below the periphery of the whorl is a marked groove, channeled and cutting the ribs as well as the interspaces. On the earlier whorls this channel revolves a short distance behind the suture, which thus appears double. This character will enable the species to be recognized when perfect specimens are found. There are three folds on the columella and the shell is about the size of *Mitra willcoxi.*"

AESOPUS (GLYPTAESOPUS) COXI, **new species.** (Plate 7, figures 11, 12.)

Shell small, slender, profile slightly inflated, somewhat fusiform, aperture about one-third the total length. Protoconch of about 3½ volutions, the first 2½, smooth, apex immersed, the last turn starting with obscure protractive axials, then rudely cancellated by three obscure spirals and merging into the postnuclear sculpture without a definite break. Beginning with the second whorl of the conch are two spiral rows of prominent nodules, axially aligned, the posterior row close to the appressed suture; the stronger anterior row somewhat angulating the whorls below mid-whorl. An obscure spiral ridge connects the nodules. By reason of the axial alignment of the nodules, there appear to be 10–11 ribs on early whorls, 11 on the penult and about 15 narrow ribs on the body. Between the rows of nodules

are fine spiral threads, reticulated by incrementals. On the body, the nodules of the anterior row become elongate axially and then extend as true ribs below the periphery and to the canal and have two or three fine axials between them, all crossed by numerous close-spaced microscopic spiral threads. The aperture is simple, contracted at the summit, without anal notch; outer lip thin, canal short, not contracted, its base slightly emarginate.

Measurements: Holotype, length, 11 mm., length of last whorl, 5.3 mm., length of aperture, 3.7 mm., maximum diameter, 3.1 mm. Whorls; protoconch, 3½; conch, 6. Another, length, 8.2 mm., apex decollate; diameter, 2.7 mm. These are the only specimens at hand. Type in U. S. N. M.

This species somewhat resembles two eastern Pacific species of *Aesopus*, neither of which has the crowded and prominent nodulation of *A. coxi*. (1) *Aesopus xenicus* Pilsbry and Lowe, 1932.[2] *A. coxi* differs in its more prominent nodulation, whorls not flattened with the body sharply contracted to the pillar. (2) *A. coxi* in some respects resembles *A.* (*Glyptaesopus*) *perornatus* Olsson, 1941.[3] The nodulations of the Ecuador species are weak and widely spaced. *A. coxi* is more slender and its axial ribs extend to the base of the canal.

NOTES ON PERPLICARIA DALL AND ITS SYSTEMATIC POSITION

By DRUID WILSON

Since Maxwell Smith's (1947) recently described gastropod *Perplicaria clarki* extends the geologic and paleogeographic range of the genus *Perplicaria* from the Atlantic Tertiary to the Panamic Recent, it seems desirable to publish these notes on the species and the genus and its systematic position.

Dall's (1890) original description of the genus *Perplicaria*

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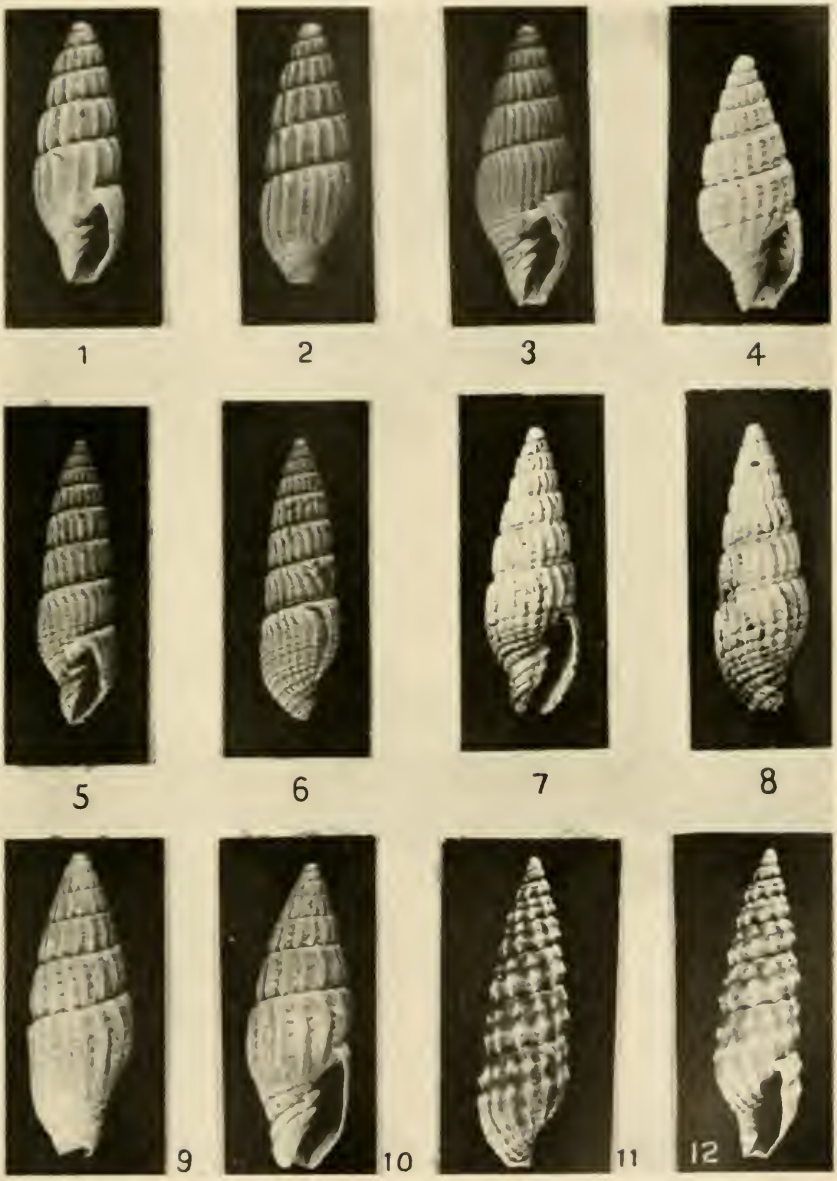
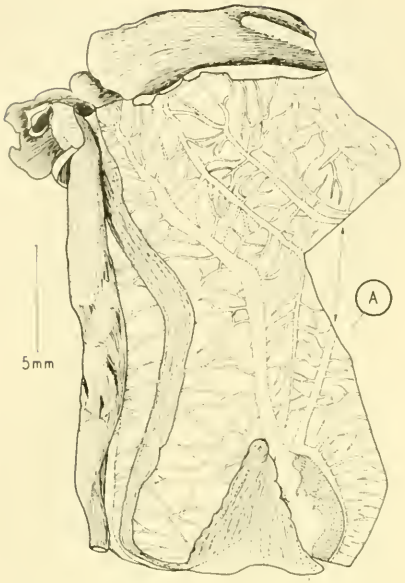
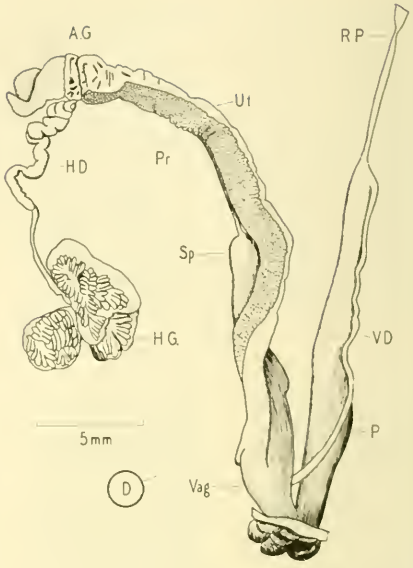
[2] "West Mexican and Central American Mollusks collected by H. N. Lowe, 1929–1931." Proc. Acad. Nat. Sci. Phila., v. 84, pp. 73, 74; pl. 14, fig. 7, Acapulco, Mexico. Length 7.5 mm.

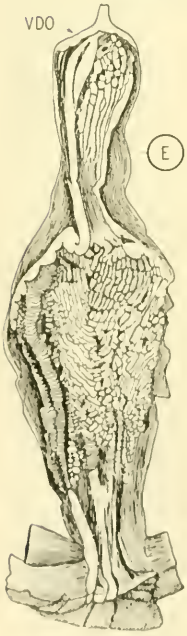
[3] "A Pliocene Fauna from Western Ecuador" by Henry A. Pilsbry and Axel A. Olsson. Proc. Acad. Nat. Sci. Philadelphia, v. 93, pp. 36, 37; pl. 10, figs. 1 and 2.

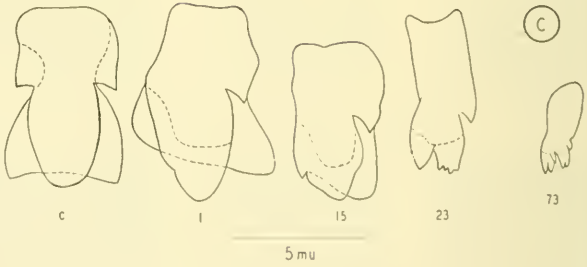


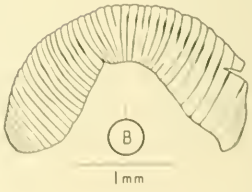
1, 2, *Vexillum* (*Uromitra*) *holmesii* (Dall), × 7. 3, *V.* (*U.*) *waudoensis* (Holmes), × 6. 4, *V.* (*U.*) *healeyi*, n. sp., immature, × 4. 5, 6, the same, elongate form, × 3½. 7, 8, the same, type, × 4. 9, 10, *V.* (*U.*) *willcoxi* (Dall), × 5. 11, 12, *Aesopus* (*Glyptaesopus*) *coxi*, n. sp., × 3.7. Photographs by Charles R. Locklin.











Diplomorpha delatouri

was based on the fragmentary monotype of *Perplicaria perplexa*. Later a perfect specimen served for further description (Dall, 1892) and the genus was referred with misgivings to the Mitridae. Cossmann (1899) followed Dall, but others (Woodring, 1928; Gardner, 1937) have noted the resemblance of species of *Perplicaria* to cancellariid genera, and the writer independently concluded that the genus belonged in the Cancellariidae. *Perplicaria* is characterized by cancellate ornamentation; an elongate though somewhat swollen, bluntly pointed spire; an obliquely plaited columella; a posteriorly constricted and anteriorly expanded aperture; the absence of even an umbilical chink; and the virtual absence of an anterior canal. These characters, probably not found combined in any other genus of the Cancellariidae, with the possible exception of the extremely oblique plaits, are present in widely differing genera within that family.

The genus is remarkable for the scarcity of specimens representing the four known species from as many horizons. Of the three named species only the genotype, *Perplicaria perplexa* Dall from the Caloosahatchee Pliocene, is known from more than one specimen. Dall's perfect hypotype and fragmentary monotype have been supplemented by two specimens, one perfect and the other a fragment, listed by Tucker and Wilson (1932). The *Perplicaria* sp. of Dall's (1903) Bowden Miocene list is probably to be identified with the "*Cancellaria*" species of Woodring (1928), described as a *Mitra*-like "*Cancellaria*." According to Woodring, this Bowden species is represented by two immature shells in the Henderson Collection. This collection also served in Dall's list. Gardner (1937) queried the generic assignment but subsumed the Chipola Miocene species *Perplicaria prior* Maury (1910) under the Mitridae, noting a resemblance to *Aphera*. *Perplicaria clarki* Maxwell Smith (1947) of the Panamic Province adds yet another genus to the link between the Atlantic Tertiary and the Recent Pacific fauna.

Thanks are extended to Dr. Katherine V. W. Palmer for verifying the Cossmann reference.

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AN AID TO THE DESCRIPTION OF RECENT AND FOSSIL GASTROPODA

By CHARLES B. WURTZ and ANNE HARBISON

To any but the specialist in the particular group concerned, a study of the descriptive literature in the field of malacology would reveal that many species, which are accepted, cannot be recognized from their descriptions. This is due, in part, to a tremendous increase in knowledge which results in the need for more precise characterization. Many students fail to recognize this. At the same time, many mollusks that have been given names should never have been described, as they are not valid species or subspecies. Such descriptions lead to needless confusion. Article 25 of the rules of nomenclature states that a description should be, "with a summary of characters (*seu* diagnosis; *seu* definition; *seu* condensed description) which differentiate or distinguish the genus or the species from other genera or species." On the basis of this, we have tried to develop a procedure to act as a guide for descriptions. The pro-

cedure is intended to be flexible enough to be used as a basis for the description of any spiral gastropod. It is presented here in the hopes that others will find it useful. Though others may not care to use it, it embraces the desiderata, and we hope that those who do not already follow a definite procedure will develop and use an outline that includes the salient features of this one. Only by having and following such a plan can the student write an adequate description.

The factors which result in unsatisfactory descriptive work are due primarily to lack of experience and to errors of judgment. Malacology has long been recognized as having passed far beyond the stage of a "hobbyist's science" and should be treated accordingly. There is still (and always will be) a field for the hobbyist, but descriptive works belong to the scientist.

Genuine study is the only solution to the first problem. This is, obviously, a matter of individual responsibility. It should never die in any real student.

As regards the second point, each student should keep abreast of systematics as a science, and allow himself to be directed by the discipline itself. We are not in a position to say what should be described, but any study of the principles of systematics will indicate many things that should not be described. Lack of training in systematics allows errors of judgment that should not be committed.

Good descriptions are essential to the biologist and paleontologist. Too many systematists write for systematists rather than for biologists and paleontologists. This is the quick route toward the divorce of systematics from biology and paleontology, and is one reason why systematics has long been frowned upon. In the past decade, the mutual needs of systematics and other biological fields has been recognized, and, now that they are once more wooing each other, the systematists should be the biologists they are presumed to be (and *vice versa*).

Other attempts have been made to present a procedure for describing a new animal, but none, so far as we know, has been designed for the Gastropoda. One recent presentation is "Procedure in Taxonomy" by Schenk and McMasters (1936). This includes an outline for the description itself. The procedure

presented here is not intended to be an outline for the description. It is an outline of the characters and features which should be taken into consideration prior to writing the description. Naturally it includes those characters which, properly, should be included in the description. Each item in the outline should be considered. Naturally, if data are lacking as regards any item nothing can be written concerning it. Negative information should be recognized, though not in writing. Failure to follow some definite plan results in "Topsy" descriptions—they just grow up. Since the Rules of Nomenclature are lacking in specificity as to what constitutes a good description, any published description must be taken into consideration by subsequent workers. At times, this results in nomenclatorial problems consuming many working days; days that could be spent more profitably.

Descriptive literature is usually found in either one of two types of literature. These are, first, the scientific journals devoted to the study of the mollusks, and, second, monographic treatments of a more or less extensive nature. Each of these presents individual problems of its own as regards information other than the description itself (e.g., geographic distribution in the broadest sense, chromosome number, variation, etc.). The journal usually includes only the description itself, but, if elaboration is desirable, this information is usually included (as "discussion") with the description. If several related species are being described, general information may best be incorporated into an introductory or concluding paragraph. In the monograph, however, the most practical method of treating such information is in summary chapters. Needless repetition occurs by the omission of summary chapters. However, the manner of presentation must remain a personal matter.

The following list of items represents an ideal that is rarely realized. It is based on the presumption that the mollusk to be described is, in fact, new to science. This is the crucial feature of systematics, and, constituting the work of the systematist, it reflects his opinion and judgment. The items are presented in what is accepted as the customary method of presentation in the description.

1. Present the systematic position of the organism. This should be done by stating the family, and, in the case of publications other than malacological publications, the class. This may be done in the title of the article (e.g., "Description of a New Species of Conidae"). If there is any variation from the characters of the next higher group (genus or family), the variation should be emphasized and the description of the higher group extended. Many students lack extensive library facilities and access to large collections of comparative material; such students must depend wholly upon the description for the determination of their material.

2. Provide a valid name for the mollusk. This requires familiarity with the rules of nomenclature and a comprehensive survey of the literature. Failure to observe either of these points results in needless work. The systematist is limited by the library at his disposal, and this limitation must be recognized.

3. Provide adequate illustrations. The more comprehensive the illustrations, the more complete will be the understanding of subsequent workers. Illustrations must show the distinguishing characters separating the new mollusk from closely related mollusks. The value of a good description is materially enhanced by good illustration. This is apparent to anyone who has ever used descriptive literature for determination in lieu of comparative material.

4. Describe the mollusk. This, as is well known, can be very difficult. A good description is not a "happy" choice of words but a studied choice. Brevity is one of the most desirable features of a description. To select the pertinent points and incorporate these, and only these, into the description demands exacting care. Before writing the description the following items should be considered in so far as possible. As is self-evident, this is not always feasible; e.g., fossil material lacks the soft tissues and is otherwise often incomplete, some gastropods lack the operculum, some are monoecious, etc.

a. Contours of the shell including the spire and apex. Sexual differences.
b. Whorl increase.
c. Contours and modifications of the aperture.

d. Umbilical region.
e. Internal armature.
f. Apical (embryonic) whorls.
g. Sculpture. First of the apical whorls, then of the later whorls. This would include any periostracal outgrowths.
h. Color patterns and color.
i. Operculum.
j. Appendages to the shell (e.g., the clausilium).
k. Dimensions.
l. External appearance of the living animal.
m. Respiratory system.
n. Excretory system including the kidney.
o. Reproductive system. Each sex if the animal is dioecious.
p. Digestive system with the jaw and radula.
q. Free retractor muscle system.
r. Nervous system.

5. Comparison with the most closely related forms emphasizing both the similarities and the differences. This would include an interpretation of the affinities of the mollusk. This, and good illustrations, represent the two most important features of the description.

6. Give the geographic range and the geologic time of the type material. Indicate the name of the collector.

7. State the disposition of the type material. Give the catalog or accession number(s) of the institution(s) selected as depositories.

These seven items represent the information that should be contained in a good description. Naturally all these will not be found in every description. This would not even be desirable as it would only result in needless repetition of generic or family characters.

Where desirable, as in an extensive monographic treatment, supplementary information may be presented in summary chapters as mentioned above. In such chapters, elaborations of such things as geographic distribution, especially as regards general statements involving the complete taxonomic group, should be considered. Distribution in geologic time; range of variation in size, color, etc.; statistical treatments; ecological information as regards the natural history of the organisms; studies of parasites; physiological observations; and all other biological in-

formation of widespread interest and general value to other than systematists themselves should be presented in these chapters. In the shorter articles, such as are found in scientific journals, such information is usually brought out under the above mentioned "Discussion."

This procedure, as we have outlined it, is, of course, idealism. But rarely all these points can be taken into consideration, but they represent information that it would be desirable to have. Many mollusks have been described without consideration of more than one or two of the above items. Yet, at the time of description, much of the information was available, and with little further effort could have been presented. Such care is troublesome, perhaps, but profitable.

ANATOMY OF DIPLOMORPHA DELATOURI (HARTMAN) AND FOUR SPECIES OF PLACOSTYLUS (PULMONATA, BULIMULIDAE)

By YOSHIO KONDO

Bernice P. Bishop Museum, Honolulu

In the course of dissecting some species of Partulidae, it was thought advisable to investigate the anatomy of *Diplomorpha delatouri* (Hartman) in order to determine its family status. Species of the genus *Diplomorpha* Ancey were at one time included in *Partula* (Cox, Proc. Zool. Soc., London, p. 644, 1871; Hartman, Proc. Acad. Nat. Sci., Philadelphia, p. 35, 1886). Ancey (Il Naturalista Siciliano, 3: 344, 1884) proposed the subgeneric term *Diplomorpha* under either *Partula* or *Bulimus* because conchologically it appeared to be intermediate between *Partula* and *Placostylus*. Pilsbry (Man. Conch., 13: 114, 1900) found that the orange-red interior of *Diplomorpha* and its apical sculpture showed its relationship with *Placostylus* rather than with *Partula;* so he assigned to it a subgeneric status under the genus *Placostylus*. Since then Sykes [Proc. Malac. Soc., London, 5(3): 197, 1902] and Clench [Nautilus 46(2): 68, 1932]

have treated it as a genus, a course which seems justified in view of the results obtained in the present study.

In regard to the anatomy of *Diplomorpha,* only one reference to it has come to my attention. Pilsbry (loc. cit., p. 115) writes: "The statement of Dr. Hartman that the anatomy is like that of *Partula* was evidently not based upon adequate knowledge of the subject. I do not regard the present group as in any sense intermediate between *Partula* and *Placostylus.*"

Pilsbry's remark refers to Hartman's statement (Proc. Acad. Nat. Sci., Philadelphia, p. 223, 1885) under *Partula layardii* Brazier: "Mr. Layard having sent me several animals in alcohol, they were referred to Mr. Wm. G. Binney, and, notwithstanding the external differences, 'he finds the jaw, lingual dentition, and genitalia like other Partulae.' "

This study shows that the anatomy of *Diplomorpha,* while differing from that of *Placostylus* in some respects, is closely related to that of *Placostylus* but, on the other hand, is in no way related to that of *Partula* except very remotely. In the first place, the kidney of *Diplomorpha* (and of *Placostylus*) has a sigmoid ureter while that of *Partula* is orthurethrous. Secondly, the teeth of *Diplomorpha* and *Placostylus* are nearly alike.

In *Partula* the central and some of the laterals are somewhat similar to those of the two other genera but the marginals show no similarity at all (cf. Pilsbry and Cooke, Bishop Museum Occasional Papers 10(14), fig. 2a, 1934 with plate 8:C and 9:C, this paper). Lastly the genitalia of *Partula* show no relationship with those of the bulimulid genera. In *Partula* the prostate gland does not descend the entire uterus, thus leaving it unencumbered, but in *Diplomorpha* and *Placostylus* the prostate is in intimate contact with the uterus, descending its entire length and forming a spermoviduct.

In regard to *Diplomorpha* and *Placostylus,* there seem to be sufficient anatomical (and conchological) differences between the two to justify elevation of the former to generic rank. While most of the teeth are similar, the extreme marginals differ in that in *Diplomorpha* the entocone and mesocone split at their tips, form a small spur between them (Pl. 8:C:73), and the ectocone becomes very minute. On the contrary, a small spur is

not formed between the entocone and mesocone in *Placostylus* and the ectocone remains fairly large (Pl. 9: C: 67–70). In the genitalia, *Placostylus* is characterized by a strongly twisted spermoviduct (Pl. 9: D), a characteristic that is peculiar to that genus and not shared by *Diplomorpha* in which the organ is straight (Pl. 8: D). Other differences exist in the genitalia but these may not be validly utilized for contrasts at this time because only a single species (and specimen) of *Diplomorpha* is available for study. Among these differences may be mentioned the membranous covering of the ovotestis of *D. delatouri* and the twisted epiphallic tubule characterizing *Placostylus*.

Diplomorpha delatouri (Hartman), pl. 8: figs. A–E.

Placostylus (*D.*) *delatouri* Pilsbry, Man. Conch., 13: 117, pl. 72: 10, 11, 12, 1900. *D. delantouri* [sic] Sykes, Proc. Malac. Soc., London, 5(3): 197, 1902.

Pallial complex (fig. A) typically bulimuloid. Lung transparent, organs and veins clearly visible. Kidney equilaterally triangular, as long as pericardium, with closed ureter and secondary or gut ureter; ureter narrow at posterior margin of lung, expanding anteriad, widest near the middle, opening near funnel-shaped aperture at pneumostome. Pulmonary vein large, with numerous small branches, terminating at pneumostomal area. Pericardial vein extending to mantle collar, with numerous branches some of which anastomose with veins from sinus venosus. (The part of the lung bearing this vein was cut to facilitate flattening.) Numerous smaller veins originate at the pericardium and enter the lung laterad. The first vein of the sinus venosus lies between the pulmonary and pericardial veins, its small branches anastomosing with those of both neighbors. Second, and perhaps third, vein of the sinus venosus may be seen at the upper right side of lung. Mantle collar with one narrow lappet (at right).

Jaw (fig. B) arcuate, with numerous narrow plaits; grooves shallow. In this specimen, the plaits of the right side increase rather than decrease in size, probably as a result of some injury.

Central tooth (fig. C: c) subquadrate, with large median cusp and two short ectocones. First lateral (C: 1) with short ectocone and large mesocone on which is a shallow notch on the inner side. From 2nd to 20th the teeth gradually diminish in size; at the

same time the lateral notch deepens to form a small entocone (C:15). Laterals gradually elongate from 20th, the entocone enlarging, the mesocone diminishing and acquiring small notches, while the ectocone also becomes smaller (C:23). From the 23rd to about 73rd the teeth gradually decrease in size, all the cones modifying until the entocone and mesocone split and a minute cone is formed between them; the ectocone becomes minute. Ninety-five rows with 85–87 teeth per half row counted.

Genitalia (fig. D): ovotestis (HG) bilobate, each lobe enclosed within a membranous sac. Duct (HD) neither heavily distended nor strongly convolute. Albumen gland (AG) small; prostate (Pr) extensive, accompanying narrow uterus (Ut) to near vagina. Spermatheca (Sp) as broad as stalk, with thin connective tissues (or muscle fibers) at apex resembling a retractor. Vagina (Vag) short. Vas deferens (VD) off uterus near vagina, adhescent to penis, entering near apex. Penis (P) over half oviducal length, narrow, with slight submedian bulge (indicating epiphallus above it), covered with thin transparent. Interior of penis (fig. E): epiphallic or narrow part with an irregular pilaster and a few folds which constrict off into scattered bosses; orifice of vas deferens (VDO) subapical, verge lacking; lower part of penis heavily rugose, most of the rugae descending diagonally with numerous wrinkles on them so that they appear to be a series of short folds connected end to end, terminating below in vague bosses. A few of the folds run dorso-ventrally (see left side) and are heavily wrinkled so that they appear roughtly as stacks of washers. Lower part with few heavy but indistinct folds. Penial retractor terminal, off nuchal membrane.

Right ommatophore through penio-oviducal angle; penis innervated by cerebral ganglion. Only one adult dissected.

New Hebrides, Aore Island off south coast of Espiritu Santo Island in Segon Channel, collected by Lt. R. L. Summers, under a large leaf, alt. 100 ft., 3 May 1943, (BBM 189730).

Placostylus (Proaspastus) hargravesi (Cox), pl. 9: figs. A–H.

Placostylus (*Proaspastus*) *hargravesi* Clench, Am. Mus. Novitates, 1129: 13, 1941.

Pallial complex (fig. A) similar to that of *P. shongii* (Pilsbry, Man. Conch. Index 10–14: li–lii, 1902; Man. Conch. 14, pl. 51: 15, 1901–1902) and nearly identical with that of *D. delatouri* except that *P. hargravesi* has an additional mantle lappet near the pneumostome. Lung long, heavily veined; pulmonary vein swollen near apex (only principal veins figured).

Jaw (fig. B) composed of about 40 distinct plaits, the median small, incomplete, wedge-shaped. Teeth (fig. C) typically bulimuloid and are as described by Clapp for *P. hargravesi aukiensis* (Bull. Mus. Comp. Zool., 65(11): 410, fig. 49, 1923) and by Rensch for *P. cleryi cleryi* (Revue Suisse de Zoologie, 42(4): 83, fig. 12, 1935). Central (c) subquadrate, with large meso- and two weak ectocones. First lateral (1) with weak ectocone, strong mesocone, but without indication of the entocone as in *D. delatouri*. Entocone is revealed gradually and at 20th tooth it is a weak blunt cone on a diminishing mesocone. Entocone is strongest at about 20th; from 20th to 21st there is a sudden transition in which the entocone enlarges while the mesocone is truncated. This change perhaps signalizes the lateral to marginal transition. In the marginals, the teeth elongate and diminish in size; in the 40th the entocone is large, the mesocone acquires a notch, while the ectocone becomes a blunt spur. From the 40th to 70th there is little change except that the entocone now acquires a new notch while the mesocone loses the same but becomes blunter.

Genitalia (fig. D) similar to that of *P. cleryi cleryi* (Rensch, loc. cit., fig. 11). Ovotestis bilobate, lobes closely appressed, multifolliculate, without membranous investment as in *D. delatouri*, duct strongly convoluted. Albumen gland large; prostate (stippled) extensive and intimately connected with uterus (both strongly convoluted several times), terminating well above vagina; vagina long; spermatheca bulbous, stalk short, with connective (or muscle) tissues at apex and side; vas deferens originating at level of spermathecal apex (arrow) and closely appressed to penial sheath three-fourths of the way then entering sheath (arrow) to continue apicad. Penis (fig. D) large, clavate, composed of thick sheath (fig. E) in which is enclosed a strongly and many-times-convoluted vermiform tubule (penis proper) about 2½ times sheath length. The lower three-fourths of the tubule is tightly packed with numerous rugae (fig. F, A–A of fig. E). The upper and smaller part of the tubule (fig. G, B–B of fig. E) contains another inner strongly convoluted tubule, also rugose (see arrows); this tubule terminates at the apex of the penis at the insertion of the penial retractor (fig. H) where it is strongly held by muscle tissues of the sheath and where it is joined by the vas deferens from one side on its apex. Verge lacking. (Penial tubule slit open its entire length after sample incisions were made and figured.)

Right ommatophore passing through penio-oviducal angle; penis innervated by cerebral ganglion. Two specimens dissected.

Solomon Islands, Malaita, Tai Lagoon, Templeton Crocker Expedition [no collector given], 31 May 1933, (BBM 119247).

The penis of *P. hargravesi* is similar to that of *P. cleryi cleryi* in that it is an elongate tubular organ enclosed within a thick sheath. It differs from that of *P. shongii* (Man. Conch. Index 10–14: lii) in which there is a pilaster below and corrugations above.

PLACOSTYLUS (ASPASTUS) MILTOCHEILUS (Reeve), pl. 10: A, B, C (upper 3 figures).

P. (*A.*) *miltocheilus* Clench, Tm. Mus. Novitates, 1129: 18, 1941.

Jaw large; radula large, twice broader than in *P. hargravesi*. Central tooth subquadrate; 1–14th teeth with slight indentation on mesocone; 15th forms entocone; 15th–83rd, gradual change to the usual type of marginals as illustrated in *P. hargravesi*.

Penis (fig. A, partly exserted) clavate, slightly swollen above, thickly sheathed (fig. B). Unsheathed penis with a bulbous apex, constricted neck, and broad midbody. Bulbous apex (fig. C) composed principally of heavy network of muscle fibers in which the strongly convoluted epiphallic tubule is enclosed (see arrows). Tubule descends narrow neck, entering a conical verge (V) the apex of which has a minute perforation. Verge is a part of the few heavy pilasters lining lower part of penis.

Right ommatophore passing through penio-oviducal angle; penial nerve off cerebral (?) ganglion. Only one specimen available for study.

The penis of *P. miltocheilus* differs from that of *P. hargravesi* in being much shorter but stouter, in having a bulbous epiphallus and a verge.

Solomon Islands, San Cristoval, Star Harbor, Templeton Crooker Expedition [no collector given], 17 January 1933, (BBM 119307).

PLACOSTYLUS (EUPLACOSTYLUS) SEEMANNI MBENGENSIS Cooke, pl. 10: A, B, C (middle 3 figures).

P. (*E.*) *seemanni mbengensis* Cooke, B. P. Bishop Museum Occ. Papers, 17(9): 92, fig. 2: a, b, 1942.

Jaw slightly smaller than in *P. hargravesi;* radula about the same size as in that species. Central tooth subquadrate; 1–16th

with slight indentation in mesocone; 17th begins and 19th forms entocone; 19th–57th, gradual change to usual type of marginal as figured in *P. hargravesi*.

Penis (fig. A) very short, nearly globose, retractor heavy; vas deferens free to midbody of penis, thence within sheath to a point near retractor, thence into epiphallic chamber via small orifice (fig. C: VDO). Sheath thick, closely connected with inner organs. Interior of lower portion (fig. B) composed of two parts: (1) the heavily rugose portion of one side and the roof (fig. B, right side and background) where rugae often take zigzag or serpentine courses and (2) the thicker portion (left, in same fig.) which is also rugose but having one or two sacs projecting from midbody of penis at the point vas deferens enters sheath. These sacs are surrounded by wrinkled folds, are not hollow but are filled with a profusion of delicate muscle fibers, and when exserted may (together with the remainder of the penial interior) inflate to a large size, as large or larger than the snail's own head. Epiphallus (fig. C) small, connecting with larger lower chamber via short narrow channel (Ch), surface slightly rugose; orifice of vas deferens (VDO) near lower part. Verge lacking.

Right ommatophore free of penio-oviducal angle; penis innervated by cerebral ganglion. Three specimens dissected.

Fiji, Mbenga Island, collected by Lindsay Verrier (Isaac), M.D., 17 February 1940, (BBM 183844).

The penis of *P. s. mbengensis* differs from that of *P. hargravesi* in being bulbous and very short, in having sac-like stimulators within, and in having a simple epiphallic chamber and tube. Semper (Reisen im Archipel der Philippinen 3: 157, 1870) studied the penis, teeth, and jaw of *P. seemanni*. He states that the penis was smaller than in *P. elobatus* (= *P. gracilis*).

PLACOSTYLUS (CALLISTOCHARIS) GRACILIS (Broderip), pl. 10: A, B, C (lowest 3 figures).

P. (*C.*) *gracilis* Pilsbry, Man. Conch., 13: 110, pl. 41: 80–83, 1900.

Jaw smaller than in *P. hargravesi*, radula nearly the same size. Central tooth subquadrate; 1st to 16th without cleft on mesocone; 17th begins and 19th forms cleft; 19th–80th, gradual change to usual type as shown in *P. hargravesi*.

Penis (fig. A) short, thick, not bulbous as in *P. s. mbengensis* but pointed; sheath (fig. B) very thick, enclosing a subconical intromittent organ to which is subapically attached a narrow epiphallic tube that is enclosed within a heavy network of muscle fibers so as to obscure the shape of the organ (most of fibers eliminated in fig.). Interior of conical penis (fig. C) heavily rugose; some rugae wrinkled, others serpentine. Interior of epiphallus a narrow passage with a few wrinkled folds; wall thick, orifice of vas deferens apical. Verge lacking.

Right ommatophore free of penio-oviducal angle; penis innervated by cerebral ganglion. One specimen only dissected.

Fiji, Viti Levu, Mataivailevu, Wainimala River, alt. 1600–2800 ft., under green leaves of *Heliconia,* collected by Dr. Harold St. John, 10 August 1937, (BBM 164462).

The penis of *P. gracilis* differs from that of *P. hargravesi* in being very short; interiorly, the organ is also short and blunt with a well defined epiphallic portion that lacks the convoluted tubule.

The genitalia, jaw, and teeth of *P. gracilis* were studied by Semper (loc. cit., p. 157, *Otostomus elobatus* Gould). He refers to the penis as a thick short sac without a penial papilla.

Description of Plates

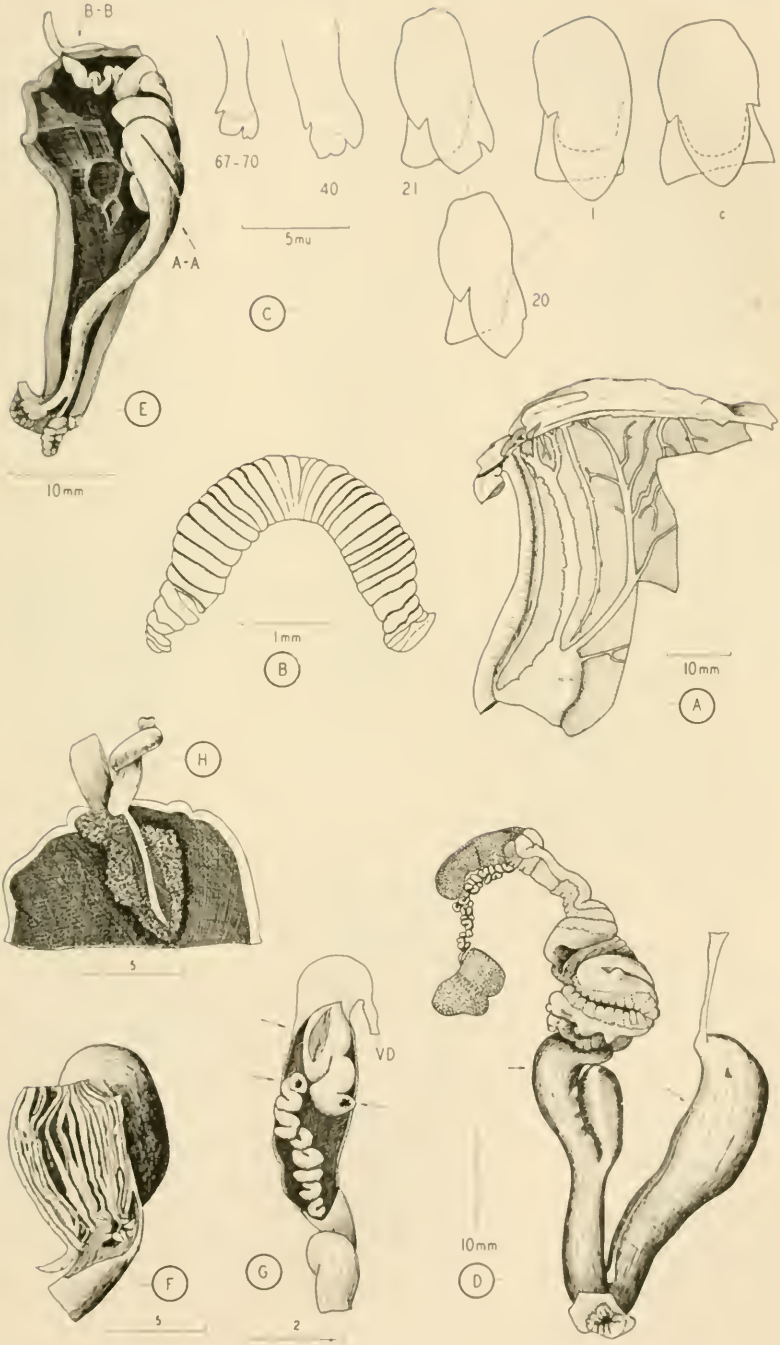
PLATE 8. *Diplomorpha delatouri* (Hartman). A. Pallial complex. Arrow points to severed ends of pericardial vein which was cut to facilitate flattening of lung. B. Jaw. Right half probably damaged. C. Teeth. D. Genitalia. E. Interior of penis.

PLATE 9. *Placostylus* (*Proaspastus*) *hargravesi* (Cox). A. Pallial complex. Only principal veins shown. B. Jaw. C. Teeth. D. Genitalia. Note strongly convoluted spermoviduct. Arrows point to origin and insertion (in sheath) of the vas deferens. E. Interior of sheath. F. Interior of penial tube at section A-A, fig. E. G. Interior of tube at B-B, fig. E. Note that another tubule is within. Arrows point to cross- and longitudinal sections. H. Apex of penis where vas deferens and tube meet.

PLATE 10. *Placostylus* (*Aspastus*) *miltocheilus* (Reeve), upper 3 figures. A. Penis with a portion of the ♀ organs. Partially exserted. B. Interior of penial sheath. C. Interior of penis and epiphallus. Note verge. Unlettered arrows point to convoluted epiphallic tubule.

P. (*Euplacostylus*) *seemanni mbengensis* Cooke, middle 3 figures. A. Penis with a portion of the ♀ organs. B. Interior of penis. C. Interior of epiphallus.

P. (*Callistocharis*) *gracilis* (Broderip), lowest 3 figures. A. Penis with a portion of the ♀ parts. B. Interior of penial sheath. Epiphallic tubule heavily enclosed by network of muscle fibers. C. Interior of penis.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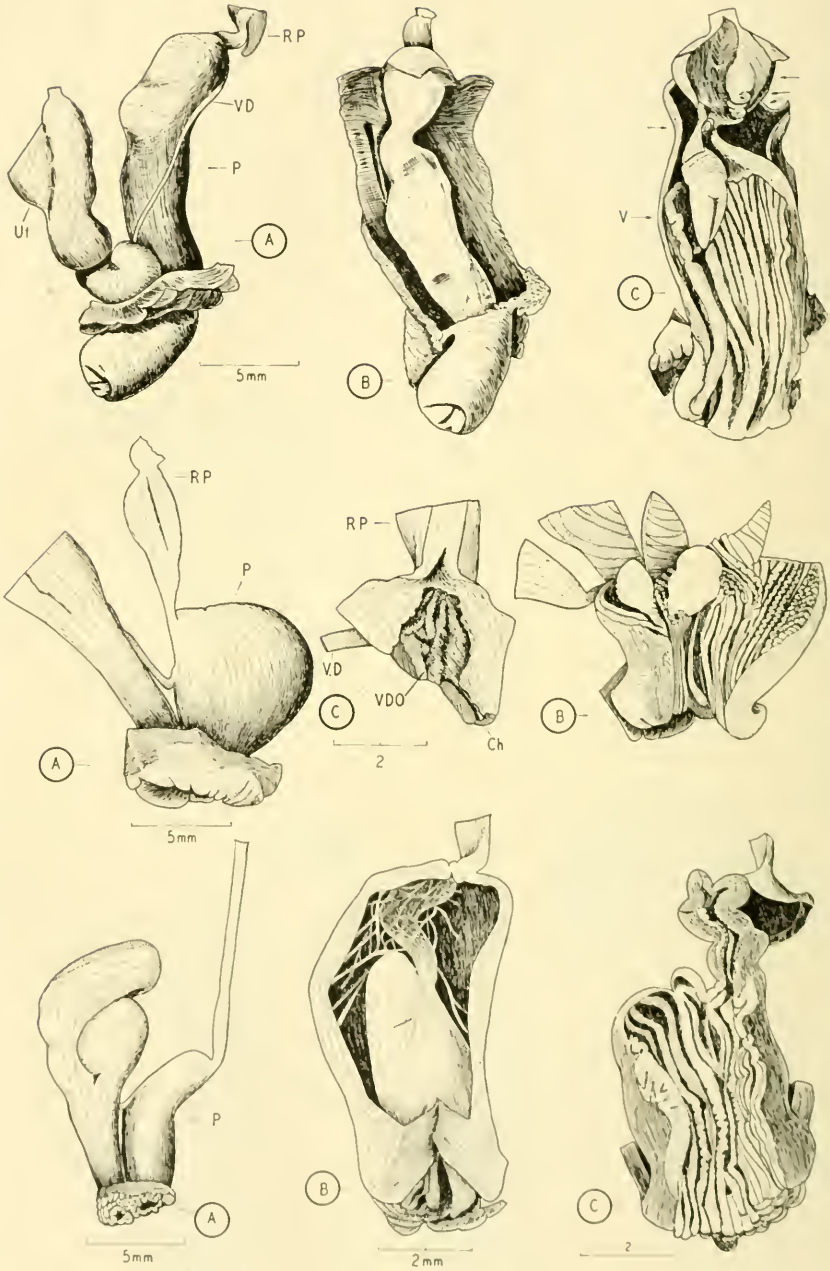
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THE TAXONOMIC AND DISTRIBUTIONAL HISTORY OF THE FRESH-WATER MUSSEL ELLIPTIO COMPLANATUS (DILLWYN, 1817)

By MAX R. MATTESON

Department of Zoology and Physiology, University of Illinois

Taxonomy. The present-day genus *Elliptio* was originally included under the genus *Unio* Retzius, 1788. Formerly, this genus included species with and without lateral hinge teeth. No type was named by Retzius. In 1792, Bruguière described the genus *Unio* as possessing teeth but he neglected to explain what should be done with those lacking lateral teeth. In 1815, Oken divided the genus *Unio* into *Lymnium* and *Unio*. The former possessed teeth whereas the latter lacked them. In 1817, Schumacher retained *Unio* for the species with teeth and introduced the new generic name *Margaritana* for those without teeth. As can be seen from the above, there is an element of uncertainty concerning the generic synonymy. Several modern authors have attempted to solve the problem in various ways. Ortmann (1911) stated that the name assigned by Bruguière has priority; thus his definition of *Unio* persists.

Ortmann made an attempt to separate most American forms from the European genus *Unio*, although Simpson (1914) had retained many of them under that genus. Ortmann also suggested that most of the American forms be placed under the generic name *Elliptio* Rafinesque, 1819, with *Unio crassidens* Lamarck as the type of the genus.

Ortmann and Walker (1922) recognized the genus *Elliptio* Rafinesque, 1819, and used *Unio crassidens* Lamarck as the type of the genus. Simpson recognized it as a section of *Unio* (1900). Hermannssen designated *Unio dilatatus* Rafinesque as the type of *Eurynia*, in 1847; Rafinesque had also used *Eurynia* in 1819; the original dates of publication are identical; and the name *Elliptio* has taken preeedence.

Elliptio complanatus (Dillwyn, 1817) is one of the most prominent speeies of the genus. Haas (1913) revived the name *Unio violaceus* Spengler, 1793. However, Walker (1918) stated that *violaceus* failed to deseribe the species sufficiently. Also,

according to the law of priority, its first name was *Mya complanata* (Portland Catalogue, 1786, p. 100).

The synonymy for *Elliptio complanatus* is very extensive. Simpson (1914) lists six complete pages of different names which have been associated with the species. *Mya complanata* was first used by Solander in an unpublished and undated manuscript. However, *Mya* refers to a salt-water species. Dillwyn (1817) recognized Solander's unpublished article but used the name *Unio complanatus* in his catalogue; and, therefore, the official name, *Elliptio complanatus* (Dillwyn, 1817), is now recognized by most authorities.

The type locality listed by Simpson (1914) and by Ortmann and Walker (1922) is Maryland and New Jersey. As it is one of the most widely distributed mussels, there is extreme variation in its physical characteristics, especially in the shell. As a result, different attempts have been made to separate the species into several subgroups. For example, Lea and several other American conchologists once decided simultaneously to combine all forms found north of Washington, D. C., under the name *Elliptio complanatus*. South of that location, they began to apply subspecific names to the varieties. The diversity of these mussels was so great that eventually they had applied names to a large number of so-called varieties and still could see no relief from the task, as each new lot continued to show differences. The most recent opinion is that there probably is a typical *Elliptio complanatus* and that, because of generic variations, one must also include the various intergrades in the same group. One observation to be emphasized is that this genus contains probably more variations in shell characteristics than any other group of unionids.

Partial descriptions of the shell characteristics may be obtained from several sources. However, the most complete account is listed by Simpson (1914). Baker (1928) also has described the species thoroughly.

In order that a clearer understanding of the present-day distribution of *Elliptio complanatus* may be obtained, it may be well to examine the evolutionary history and development of the unionids, the genus *Elliptio*, and, finally, of the species involved. The story of evolutionary development of the Unioni-

dae has necessarily paralleled the historical geology of the world. As world topography changed through the action of diastrophic and erosive processes, the unionid fauna also became altered. Mussels, in order to cope with the changing environment, were forced to modify their anatomy or their life habits, or, perhaps, if conditions became unbearable, to migrate. Those groups for which none of the preceding operations were possible became extinct.

The Unionidae, although now entirely inhabitants of fresh water, must have developed from some marine pelecypod. The specific ancestral type has not yet been positively determined. This group, although similar to marine members of the class in general, is so definitely different from marine pelecypods in several morphological and physiological aspects that the possibility of multiple origin is quite inconceivable. Thus, it may be safe to assume that one marine form played the ancestral role for the entire family.

The point of origin of the Unionidae, according to geological evidence up to the present, is located in the southwestern section of North America. From this area dispersal has occurred to the extent that today every continent possesses representatives in varying numbers (White, 1877). Proliferation of the group from one continent to another was facilitated by the occasional presence of connecting landbridges. These were necessary because the group was no longer able to tolerate marine conditions.

Speculation as to the procedure by which migration was effective is widespread, but unconfirmed. Present-day migration is promoted for the major part by fish, in which unionids necessarily spend part of their life cycle as parasites. If the original unionids followed the same procedure, suitable fish must have been available to act as hosts. Evidence from various regions shows that soon after evolution of the original mussel type, fishlike animals appeared on earth. There is the possibility that the newly evolved unionids may have continued some of the habits of their marine ancestors for a considerable period following the differentiation. If this were true, it is highly plausible that the parasitic stage of the life cycle, which commonly is spent in a fish, had not yet evolved. Therefore, it is

reasonable to assume that the first representatives could have existed before the advent of fish.

Evolutionary Development. In order to have a full understanding of conditions under which the modern genus *Elliptio* arose, geological history must once again be examined. Present-day knowledge concerning the geological changes involved is much more concrete than are many of the details related to the early development of the genus *Elliptio*. This is unusual, as the geological history of the area involved, specifically in relation to stream development, has to a marked degree been determined from a study of the living residents of that area.

The forerunner of *Elliptio* has not been positively identified. However, *Elliptio* has many characteristics which also are possessed by members of the European genus *Unio*, which formerly included many groups that now have been established as definite separate genera by recent workers in the field. The immediate ancestor of *Elliptio* may have been some member, perhaps now extinct, of the genus *Unio*, or perhaps more accurately the subfamily Unioninae.

The point of origin of the genus *Elliptio* must have been somewhere in western Georgia or eastern Alabama, or perhaps, northwestern Florida. The exact time when it appeared is unknown, but probably it was either early or middle Tertiary. It soon became well established in many of the streams which entered the Gulf of Mexico at that time.

Theories concerning the geological changes which have influenced the dispersal of various species of *Elliptio* have been subject to controversy since their proposal. Hays and Campbell (1894), basing their argument upon geological and physiographical indications, declared that the Tennessee River formerly flowed southward, east of Walden Ridge, and thence into the present Alabama River system. Near the end of the Tertiary, a tributary of the Sequatchie River cut through Walden Ridge and joined the upper Tennessee, causing it to flow westward as it does at present.

Simpson (1900) verified the theory by revealing the close relationship between mussels of the two systems. Adams (1901) later supported his views.

Johnson (1905), after studying the area involved, declared

that the Tennessee had always followed its present course. Ortmann (1913) stated that, because of evidence secured from the distribution of related mussels, the two systems were once connected. Van der Schalie (1938) supported the junction concept through an analysis made of shells from the Cahaba, a tributary of the Alabama. Johnson (1939) suggested that some agent other than stream convergence might have been involved. Van der Schalie (1939) gives little credence to the theory that mussels could have been carried from one system to another by animals other than fish but maintains that stream convergence must have been the logical method of transfer.

In the opinion of the writer, mussels have extended their range principally through the agency of stream confluence for the following reasons: (1) the topography of the region involved, as reported both by literature and by discussion of the problem with informed residents of the area; (2) the systematic pattern exhibited by the molluscan fauna and other animals of the river systems in question.

At one time during the late Tertiary period, the upper limits of at least five streams were involved almost simultaneously in the process of altering their courses: the Tennessee, immediately east of Chattanooga, the Coosa River, a tributary of the Alabama, the Etowah River, a tributary of the Coosa, the Chattahoochee River, and the Savannah River. Of the five, only the Savannah has always flowed into the Atlantic.

Two members of the genus *Elliptio* were established in the upper Tennessee before it separated from the Alabama River drainage system, *Elliptio dilatatus* and *Elliptio crassidens*. After the transfer had occurred, *Elliptio dilatatus* migrated throughout the Mississippi drainage system and Great Lakes region, whereas *Elliptio crassidens* remained in the present Tennessee system, except in a few isolated areas of the Mississippi drainage.

Near the time when the preceding phenomenon was occurring, the Chattahoochee River stole one of the tributaries of the Etowah River, which is a part of the Alabama drainage. This allowed the elliptios to pass freely from one system to the other. Which one possessed them originally is a question for debate. However, unless the connection between the Tennessee and Coosa

remained open for some time it is reasonable to believe that the Etowah must have contained them originally, unless the connection between the Chattahoochee and Etowah preceded that of the Coosa and Tennessee for a length of time sufficient enough to permit the migration of the genus. During the same epoch, one of the tributaries of the Chattahoochee disassociated from that system and became a part of the Savannah. As *Elliptio complanatus* is typically a medium-to-large stream form, the number of species of the genus must have been small at that time of junction because, otherwise, the volume of the connecting waters would have allowed other species to reach the Atlantic drainage. At present, *Elliptio complanatus* is the only member of the genus to occupy that entire drainage.

(*To be continued*)

A MIXED COLONY OF CEPAEA NEMORALIS AND CEPAEA HORTENSIS ON LONG ISLAND, NEW YORK

By ROBERT C. FLIPSE

Since its discovery in September, 1945, there has been flourishing a colony of *Cepaea nemoralis* (Linné) and *Cepaea hortensis* (Müller) on Long Island, near Douglaston, Queens County, in New York City. This colony was first noticed from a passing automobile by the profusion of mucous trails on the highway. The snails were found in abundance, *Cepaea hortensis* apparently being the predominating species.

The origin of this colony is somewhat obscure. It is located approximately one hundred yards south of Northern Boulevard at the edge of a tidal swamp adjoining the Cross Island Parkway. This swamp is part of Little Neck Bay, emptying into Long Island Sound. The swamp water is brackish due to the overflow from two local ponds, as well as some springs in the vicinity. The land itself, on which the animals were found, is "fill" used in construction of the Parkway along Little Neck Bay about ten years ago. The source of this fill is unknown. Possibly the snails were introduced on bushes and trees used in land-

scaping. However, the occurrence of *both* species together in the limited area the colony occupies is the unexplainable factor. The snails were found in great numbers clinging to the vegetation at the edge of the swamp, in the deep grass bordering the highway, on the curb, on the roadway proper, and in the large sewer drain of the roadway. A few specimens were found on the opposite side of the road, although survival in that location was difficult at best, due to regular mowing of the grass. Attempts are being made to introduce the colony elsewhere in Douglaston, and in Jamaica, Long Island.

Regarding records of *Cepaea nemoralis*, Pilsbry[1] lists Flushing, Long Island (4 miles distant) as the last Long Island record (1906). He cites H. Prime[2] who lists, in addition to Flushing, Astoria (8 miles distant), and Lloyd's Neck, Suffolk County (22 miles distant), as other Long Island records, all circa 1894. Prime states that, at the time of publication, the Lloyd's Neck colony was already extinct. Twenty-eight specimens of *C. nemoralis* were collected by A. Burnham at Flushing in 1932. These are now in the collection of the Museum of Comparative Zoölogy, Cambridge, Massachusetts.[3] To my knowledge, this is the last record of this species prior to the writer's discovery.

According to Pilsbry,[1] *Cepaea hortensis* is represented in the whole of New York State only by "unlocalized records from . . . Long Island, N. Y." He cites no dates for these records. The only record of this species in New York State at the Museum of Comparative Zoölogy is the Douglaston colony.

None of the available literature cites an instance of both *C. nemoralis* and *C. hortensis* being found together in U. S. The Douglaston colony, therefore, is offered as the first such instance.

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[1] 1939, Pilsbry, H. A.: Land Mollusca of North America (North of Mexico). I, Part 1, pp. 9–10.

[2] 1894, The Nautilus, 8: 6, p. 70.

[3] 1932, M. C. Z. Catalogue 74,522 (September 14, 1932).

LAMARCK'S PRODROME D'UNE NOUVELLE CLASSIFICATION DES COQUILLES

By HENRY DODGE

(*Continued from page 70*)

BIVALVE SHELLS

(a) Asymmetrical shells.

70. ACARDE. *ACARDO.* [Bruguière 1789.?] [1]

Composed of two equal horizontal valves, with neither hinge nor ligament. Acarde comprimee. Brug.dict.p.1,t.173.

71. OSTRACITE. *OSTRACITES.*

[Gessner 1758, Lamarck 1799.]

Inequivalve, exterior striated; the lower valve turbinate; the upper convex or conical; no hinge nor ligament. . . .

72. CAME. *CHAMA.* [Linné 1758.]

Fixed, inequivalve; hinge consists of a single, very heavy, oblique tooth. *Chama lazarus.* Lin. The Flaky cake.

73. HUITRE. *OSTREA.* [Linné 1758.]

Fixed, inequivalve; hinge without teeth; an oblong pit, crossed by a furrow, provides for the attachment of the ligament. *Ostrea edulis.* Lin.

74. VULSELLE. *VULSELLA.* ['Bolten' Röding 1798.]

Free, longitudinal, subequivalve; hinge without teeth, calloused, flattened; ligamental pit rounded or conical, terminated by a very short, curved beak.[2] *Mya vulsella.* Lin.

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[1] The figures of *Acardo* in pls. 172–173 of the Encyclopédie Méthodique show at least three different things including one object which Deshayes concluded was the epiphysis from the backbone of a whale. It is uncertain just which of these objects Bruguière was describing.

[2] The original description has the comma preceding the last phrase, as I have left it; indicating that the "beak" ("bec" in the original) meant an extension of the ligamental pit and not the umbones themselves, a feature which Lamarck always called "crochets." The ligamental pit in *Vulsella* has a spout-like extension which is characteristic.

75. MARTEAU. *MALLEUS.* [Lamarck 1799.]

Free, slightly gaping near the umbones, adherent by a byssus, and equivalve; hinge without teeth, calloused, provided with a conical pit, placed obliquely on the edge of each valve. *Ostrea malleus.* Lin.

76. AVICULE. *AVICULA.* [Bruguière 1792.][3]

Free, slightly gaping near the umbones, adherent by a byssus, inequivalve; hinge without teeth, calloused; ligamental pit oblong, near to and parallel to the edge. *Mytilus hirundo.* Lin.

77. PERNE. *PERNA.* [Bruguière 1789.]

Free, flattened; interior hinge composed of several long, parallel teeth, not articulated and set in a straight line, transverse line. *Ostrea ephipium.* Lin.

78. PLACUNE. *PLACUNA.* [Bruguière 1789.]

Free, flattened; hinge interior, composed of two sharp, divergent ribs arranged to form a "V". *Anomia placenta.* Lin.

79. ANOMIE. *ANOMIA.* [Linné 1758.]

Inequivalve, attached by the operculum [sic]; the lower valve pierced or slotted at the umbo, this aperture being closed by a little operculum attached to the foreign body, and in turn attached to the ligament. *Anomia ephipium.* Lin.

80. CRANIE. *CRANIA* [Retzius 1781.]

Inequivalve; the lower valve, almost flat and sub-circular, is pierced, on its internal aspect, by three unequal, oblique holes; the upper, very convex, is provided internally with two projecting callosities. *Anomia craniolaris.* Lin.

(b) Symmetrical shells.

81. MYE. *MYA.* [Linné 1758.]

Oblique, gaping at both ends; hinge without teeth, callous, protuberant. *Mya truncata.* Lin.

[3] Bruguière did not describe *Avicula* either in the Index to Vol. 1 nor in the alphabetical arrangement of genera in the text of that volume. It is described on page 536 of Vol. 1 (1792) in the Article "Conchyliologie," as the first genus under "Diconchae figuratae" in the heading "Methode de Klein." This description is adequately full and characteristic.

82. SOLEN. *SOLEN.* [Linné 1758.]

Oblique, the upper edge straight or nearly so, gaping at both ends. In all there are only two or three teeth in both valves. *Solen vagina.* Lin.

83. GLYCIMÈRE. *GLYCIMERIS.* [Lamarck 1799.]

Oblique, gaping at both ends; hinge without teeth, callous, protuberant.[4] *Mya glycimeris.* Born.mus.,t.1,f.8.

84. SANGUINOLAIRE. *SANGUINOLARIA.*

[Lamarck 1799.]

Oblique, upper edge curved, slightly gaping at the extremities; two cardinal teeth, close together and articulated, in each valve. *Solen sanguinolentus.* Gmel.syst.nat.5,p.3227.

85. CAPSE. *CAPSA.*[5]

[Bruguière 1797, *nomen nudum;* Lamarck 1799.]

Oblique; two cardinal teeth in one valve; one tooth in the other valve, interposed or entrant. *Tellina angulata.* Lin.

86. TELLINE. *TELLINA.* [Linné 1758.]

Oblique or orbicular, with a fold on the anterior end; one or two cardinal teeth, two lateral teeth widely separated. *Tellina virgata.* Lin.

87. LUCINE. *LUCINA.*

[Bruguière 1797, *nomen nudum;* Lamarck 1799.]

Sub-orbiculate, having no fold on the anterior end; cardinal teeth variable [in number]; two lateral teeth widely separated. *Venus edentula.* Lin.

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[4] This is not *Glycymeris* of Da Costa 1778 (*Pectunculus* Lamarck 1799), which is in *Arcidae.* Lamarck's *Glycimeris,* his name being preoccupied, is now *Panope* Ménard 1807, in *Saxicavidae,* having the same type as given by Lamarck, i.e. *Panope glycimeris* (Born) described as *Mya.* Even if the "examples" in the Prodrome are not to be taken as type designations, *glycimeris* was later designated as type by Children in 1823, virtually by monotypy. Legally, though highly technically, Lamarck's *Glycimeris* is *not* preoccupied by Da Costa's genus, the spelling being different, but this situation may one day be corrected by a suspension of the rules.

[5] Not *Capsa* Lamarck 1801, which is synonymous with *Asaphis* Modeer 1793; nor *Capsa* Lamarck 1818, which is synonymous with *Iphigenia* Schumacher 1817.

88. CYCLADE. *CYCLAS.*

[Bruguière 1797, *nomen nudum;* Lamarck 1799.]

Sub-orbiculate or slightly oblique, equivalve, having no fold on the anterior end; two or three cardinal teeth; lateral teeth elongated, laminar and entrant. *Tellina cornea.* Lin.

89. VÉNUS. *VENUS.* [Linné 1758.]

Sub-orbicular or oblique; three close-set cardinal teeth, of which the outer two (latérales) are more or less divergent. *Venus mercenaria.* Lin.

90. MÉRÉTRICE. *MERETRIX.* [Lamarck 1799.]

Sub-oblique or orbicular; three close-set cardinal teeth, and one isolated tooth placed under the lunule. *Venus meretrix.* Lin.

91. DONACE. *DONAX.* [Linné 1758].

Oblique, inequilateral; two cardinal teeth in the left valve, and one or two lateral teeth, widely separated, in each valve. *Donax trunculus.* Lin.

92. MACTRE. *MACTRA.* [Linné 1767.]

Oblique, inequilateral, and slightly gaping; a cardinal tooth folded into a trough, and accompanying a ligamental pit; two lateral teeth, compressed and entrant.[6] *Mactra stultorum.* Lin.

93. LUTRAIRE. *LUTRARIA.* [Lamarck 1799.]

Oblique, inequilateral, gaping at the ends; two oblique, divergent cardinal teeth, accompanying a large ligamental pit; lateral teeth lacking or contiguous to the pit. *Mactra lutraria.* Lin.

94. PAPHIE. *PAPHIA.* ['Bolten' Röding 1798.]

Sub-oblique, inequilateral, valves closed; ligamental pit situated under the umbones between the teeth of the hinge or near them. . . .

95. CRASSATELLE. *CRASSATELLA.* [Lamarck 1799.][7]

Inequilateral, sub-oblique, the valves closed, with a depressed

[6] This is not a particularly convincing description and does not cover the peculiar hinge nor the mode of separation between the condrophoric and ligamental pits. It would be difficult, with this description, to distinguish this genus from *Spisula* Gray.

[7] Not *Crassatella* Lamarck 1801, which is, because of pre-occupation, *Crassatellites* Kruger 1823.

lunule and escutcheon; ligamental pit placed under the umbones, above the hinge teeth. *Mactra cygnaea.* Chem.6,t.21,f.207.

96. BUCARDE. *CARDIUM.* [Linné 1758.]

Sub-cordiform, edges of valves serrate; hinge with four teeth, there being two adjacent oblique cardinals in each valve, articulating cross-wise with those in the opposite valve; lateral teeth remote and entrant. *Cardium aculeatum.* Lin.

97. ISOCARDE. *ISOCARDIA.* [Lamarck 1799.]

Cordiform, umbones separated, unilateral, involute and divergent; two cardinal teeth, flattened and entrant; one isolated lateral tooth situated under the escutcheon. *Chama cor.* Lin.

98. CARDITE. *CARDITA.* [Bruguière 1789.]

Inequilateral; hinge with two teeth unequal in size, one short tooth placed under the umbones, and a long one extending under the escutcheon. *Chama calyculata.* Lin.

99. TRIDACNE. *TRIDACNA.*

[Bruguière 1797, *nomen nudum;* Lamarck 1799.]

Inequilateral, sub-oblique; hinge with two compressed, entrant teeth; gaping at the lunule. *Chama gigas.* Lin. The Tiled Roof.

100. HIPPOPE. *HIPPOPUS.* [Lamarck 1799.]

Inequilateral, sub-oblique; hinge with two compressed, entrant teeth; not gaping at the lunule. *Chama hippopus.* Lin. The Rosette.

101. TRIGONIE. *TRIGONIA.* [Bruguière 1789.]

Inequilateral, sub-trigonal; hinge with two large flat teeth, divergent and transversely furrowed.[8] *Trigonia.* . . . Encycl. t.237. Naturforsch.15thEdition,t.4.

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[8] This is the least accurate and least characteristic of the Prodrome's usually good descriptions of the pelecypod hinge. It is not only incorrect as to the number and arrangement of teeth, but conveys no idea of the peculiar hinge of the genus, which is the most closely interlocking of any bivalve. The shells of this genus were said to have been very rare in Lamarck's day and possibly he had not seen a specimen.

102. ARCHE. *ARCA.* [Linné 1758.]

Oblique, inequilateral; hinge straight and furnished with a series of numerous parallel, articulated teeth; ligament external. *Arca noe* [sic] Lin.

103. PÉTONCLE. *PECTUNCULUS.* [Lamarck 1799.][9]

Orbicular, sub-equilateral; hinged on a curved line and with a series of numerous parallel and articulated teeth; ligament external.[10] *Arca pectunculus.* Lin.

104. NUCULE. *NUCULA.* [Lamarck 1799.]

Almost triangular, inequilateral; hinged on a broken line and furnished with numerous oblique, parallel teeth; one oblique, furrowed cardinal tooth out of line; umbones touching and turned backwards. *Arca nucleus.* Lin.

105. MULETTE. *UNIO.* [Retzius 1788.]

Oblique, with three muscular impressions; one irregular, calloused, articulated cardinal tooth extending under the escutcheon. *Mya margaritifera.* Lin.

106. ANODONTE. *ANODONTA.* [Lamarck 1799.]

Oblique, with three muscular impressions; hinge simple, without teeth. *Mytilus cygneus.* Lin.

107. MODIOLE. *MODIOLUS.* [Lamarck 1799.]

Sub-oblique, the posterior edge very short, the umbones inclining towards the short side of the shell; a single muscular impression; hinge simple, without teeth. *Mytilus modiolus.* (Linné's name omitted.)

108. MOULE. *MYTILUS.* [Linné 1758.]

Long, with terminal umbones, projecting and pointed, attached by a byssus; a single muscular impression; hinge usually without teeth. *Mytilus edulis.* Lin.

109. PINNE. *PINNA.* [Linné 1758.]

Long, wedge-shaped, pointed at its base [sic], gaping along

[9] See footnote on *Glycimeris* No. 83.

[10] *Pectunculus* appears to be preoccupied by *Pectunculus* Huddesford 1770 (fide Dall 1912) and for this reason, and because Da Costa's *Glycymeris* 1778 is earlier, it is supplanted by *Glycymeris.*

the upper edge, and attached by a byssus; hinge without teeth; ligament lateral, very long. *Pinna rudis.* Lin.

110. HOULETTE. *PEDUM.*

[Bruguière 1797. *nomen nudum;* Lamarck 1799.]

Inequivalve; hinge without teeth; ligament external and contained in a groove; lower valve notched. *Ostrea spondyloidea.* Chem.8,t.72,f.669 and 670.

111. LIME. *LIMA.*

[Bruguière 1797, *nomen nudum:* Cuvier 1798.]

Inequilateral, eared, gaping slightly on one side; hinge without teeth, ligament external, umbones separated. *Ostrea lima.* Lin.

112. PEIGNE. *PECTEN.* [Müller 1776.]

Eared, slightly inequivalve, umbones touching; hinge without teeth; ligament internal, placed in a pit. *Ostrea jacobaea.* Lin.

113. PANDORE. *PANDORA.* [Hwass (in) Chemnitz 1795.]

Inequivalve and inequilateral; two long, divergent cardinal teeth in the upper valve; two oblong pits in the other valve. *Tellina inequivalvis.* Lin.

114. CORBULE. *CORBULA.*

[Bruguière 1797, *nomen nudum;* Lamarck 1799.]

Inequivalve, sub-oblique, free; one conical, curved and articulated cardinal tooth. *Corbula* . . . Encyclop.t.230.

115. TEREBRATULE. *TEREBRATULA.* [Müller 1776.]

Inequivalve, attaching itself by a ligament or a short tube; the largest valve perforated or slotted at its umbo, which is prominent and almost in the form of a beak; hinge with two teeth. *Anomia terebratula.* Lin.

116. CALCEOLE. *CALCEOLA.*[11] [Lamarck 1799.]

Inequivalve, turbinate flattened on the back; the larger valve

[11] Lamarck, like Linnaeus, made no distinction between Mollusks and Brachiopods, and gives here several genera of the latter (*Crania, Terebratula, Orbicula* and *Lingula*). As late as 1856 *Calceola* is called a Brachiopod in Davidson's monograph on that group. It was apparently listed by Lamarck as a Brachiopod, but has since been shown to be a genus of fossil corals. His "example," *Anomia sandalium,* is attributed to Gmelin but

shaped like a half-slipper, with one to three small teeth in the hinge; the smaller valve flat, semi-orbiculate, in the form of an opereulum. *Anomia sandalium.*· Gmel.syst.nat.4,p.349. [Corrected: Tom.1,pt.4,p.3349].

117. HYALE. *HYALAEA.* [Lamarck 1799.]

Inequivalve, dilated, transparent, gaping under the umbo, tricuspid at the base, valves more or less united. *Anomia tridentata.* Forsk.p.124,et ic.t.40,f.6.

118. ORBICULE. *ORBICULA.* [(?) Cuvier 1798.]

Orbicular, flattened, fixed; lower valve very thin, adherent to the foreign body; hinge unobserved.[12] *Patella anomala.* Müll. zool.dan.p.14,t.5,f.1–7.

119. LINGULE. *LINGULA.*

[Bruguière 1797, *nomen nudum;* Lamarck 1799.]

Long, flattened, truncate anteriorly; hinge without teeth; umbones straight and pointed, joined to a fleshy pedicle which serves as a ligament for the valves and an attachment for the shell.[12] *Patella unguis.* Lin. Seba mus.3,t.16,No.4.

---

was described earlier by Linnaeus in the Mantissa 1771. Hanley found in the same unmarked box in Linnaeus' cabinet a specimen of "*Calceola sandalina,*" Lamarck's later name for the species, and a specimen of *Goniophyllum pyramidale,* another fossil coral which was once thought to be a second species of *Calceola.* See Zittel's Textbook of Paleontology where both genera are described and the two above-mentioned species figured.

[12] *Orbicula* and *Lingula.* It is curious that Lamarck, having indicated two valves in the descriptions of these genera, should have chosen "examples" from *Patella.* Sowerby (Conch. Man) points out that the "ancient writers" were confused because they had only seen single valves of *Lingula,* but this excuse could not be used by Lamarck. However, in the "Animaux sans vertèbres" he abandons the identification with *Patella* and cites as sole species for the two genera, *Lingula norvegica* and *Lingula anatina* respectively. Some writers assert that Cuvier's *Orbicula* is not identical with Lamarck's genus but is rather a synonym of *Crania* Retzius (supra), whereas Lamarck's and Sowerby's *Orbicula* is *Discina* Lamarck. *Crania* is, however, distinguishable by having no fissure in the lower valve, the shell being attached directly to the foreign body, whereas *Orbicula* Lamarck at least is attached by a fibrous member through a slot in the lower valve. I have seen no description nor specimen of *Orbicula* Cuvier. (See Sowerby, Conch. Man. and Woodward, Man. Moll. on the genera mentioned.)

MULTIVALVE SHELLS

120. PHOLADE. *PHOLAS.* [Linné 1758.]

Two large, oblique valves, gaping, and one or several small valves articulated with them and placed on the ligament or on the hinge. *Pholas dactylus.* Lin.

121. CHAR. *GIOENIA.* [Bruguière 1789.]

Three unequal valves, their exteriors concave, spreading at their extremities and united at their center to the animal which is their common axis. *Giaenia.* . . . Encyclop.t.170.

122. TARET. *TEREDO.* [Linné 1758.]

Tubular, cylindrical, open at both ends; the lower orifice provided with two lozenge-shaped valves. *Teredo navalis.* Lin.

123. FISTULANE. *FISTULANA.* [Forskål 1775.]

Tubular, club-shaped, opened at its slender extremity, and contained, in its cavity, two unconnected valves. *Teredo clava.* Gmel.syst.nat.4.p.3748.

124. OSCABRION. *CHITON.* [Linné 1758.]

Elliptical, composed of several transverse valves, imbricate, and united at their extremities, by a circular ligament. *Chiton tuberculatus.* Lin.

125. BALANE. *BALANUS.* [Da Costa 1778.]

Conical, fixed by its base, and composed of six articulated valves; the aperture closed by a four-valved operculum. *Lepas balanus.* Lin.

126. ANATIFE. *ANATIFA.*

[Meuschen 1787 (Anatifera); Bruguière 1789.][13]

Cuneiform, composed of several unequal valves joined at the

[13] Bruguière "designated" several new generic names for mollusks in the Encyclopédie Méthodique by figuring one or more species on a plate headed by the proposed generic name, but supplying no description nor any specific names. As this sort of designation does not comport "an indication, or a definition, or a description" under Rule 25(a) and Opinion 1, these genera cannot be attributed to Bruguière but must be cited as of the first later author who validly described them. In most of these cases that will be Lamarck 1799.

extremity of a fleshy tube, fixed by its base; aperture without operculum. *Lepas anatifera.* Lin.

NOTES AND NEWS

The Boston Malacological Club, having an active membership of 60, with 14 non-resident members, met the first Tuesday of each month from October through May 1947, with an outing held in June at the home of one of the members, Mrs. Roberts, on the Annisquam River, Cape Ann, Massachusetts. The officers of the Club during the 1946–47 season were: President, Dr. Merrill E. Champion; Vice-President, Richard W. Foster; Secretary-Treasurer, Mrs. Roy C. Athearn; Conchological Recorder, Miss Ruth Turner; Executive Committee, the Officers, Mr. W. J. Clench, Mrs. Earl Pride.

Speakers and topics during the season were: Dr. Joseph Bequaert, "Adanson, the First Zoological Malacologist"; Dr. David Belding, "Economic Value of Mollusks"; Capt. C. M. Dumbauld, "Collecting Mollusks in the Perlas Islands, Panama"; Mr. Richard W. Foster, "The Preparation of a Bibliography of the Literature on Molluscan Biology"; also, "Dredging in Florida"; Mr. William J. Clench, "The Evolution of Tanganyika Mollusca"; also "Collecting in New England"; also "Liguus Collecting in Florida"; Dr. A. W. Cheever, "Recent Florida Ramblings"; Mrs. Athearn, "Scenic New England"; Various Club Members, "Summer Activities."—Mrs. Roy C. Athearn.

Carl Hegner.—Those who attended the A. M. U. meetings at Pacific Grove last June will be sorry to hear of the sudden death of Mr. Carl Hegner, at Los Angeles, on January 6th, 1948. While Mr. Hegner still was a beginner in conchology, he had shared other hobbies with several C. S. C. members and his pleasant personality will be greatly missed.—Elsie M. Chace.

Extinction of Monadenia fidelis semialba (Henderson) Eyerdam.—This distinct race, which was restricted to a narrow strip about 300 yards long by 100 yards wide among the rocks

and underbrush behind Rosario Beach, Fidalgo Island, Skagit Co., Washington, has apparently vanished into limbo to meet its ancestors.

On January 8th, 1948, I made an excursion with Mr. Philipps Putman of Anacortes to Rosario Beach in search of this snail. It was the first time since 1940 and conditions had greatly altered in the area, with modern improvements. Where formerly a thick underbrush and leaf cover with many old logs had furnished a natural cover for snails and a number of rare native plants, there is now a decided touch of civilization. All logs and underbrush have been cleared away; the ground has been scrupulously raked over; and it is now covered with a thin mat of Linné's flower, *Linnaea borealis*, var. *americana*. This condition is in itself an improvement and an asset to the public, but is somewhat of a disappointment to the nature lover, especially to the conchologist.

Careful search was made of the entire area, with two worn old shells as the only results. Evidently those live specimens that were raked up were either collected by the rakers or were carried away by birds or squirrels. When Mr. and Mrs. E. A. Chace and I searched the area in August of 1937, we found over 100 good shells of this subspecies. On this last occasion (1948), it was warm and moist enough for snails to be about, because I saw a garter snake hunting for his dinner.

I have two specimens of this race that were collected by C. F. Newcomb in 1890 in the vicinity of Victoria, B. C., which is on Vancouver Island directly westward across Puget Sound from Fidalgo Island. Possibly this race of *Monadenia fidelis* also occurs rarely on the larger islands of the San Juan group, which lie between Fidalgo Island and Victoria. I have seen typical *M. fidelis* from the San Juans.—Walter J. Eyerdam.

Dr. Pilsbry, our senior editor, has flown down to Peru, to visit his daughter, Mrs. Barcroft. When last heard from, Mr. Olsson and he were headed for the mountains. Good snailing!

Vol. 61 JULY, 1947 No. 1

THE NAUTILUS

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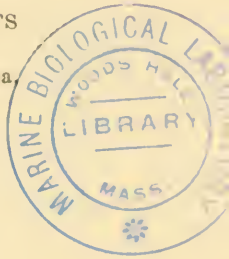

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DATES OF THE NAUTILUS.—Volume 60, no. 1, pp. 1–36, pls. 1–3, was mailed August 30, 1946. No. 2, pp. 37–72, pls. 4–6, December 18, 1946. No. 3, pp. 73–108, frontispiece and pl. 7, March 11, 1947. No. 4, pp. 109–148 + i–iv, June 2, 1947.—H. B. B.

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